FIG.1

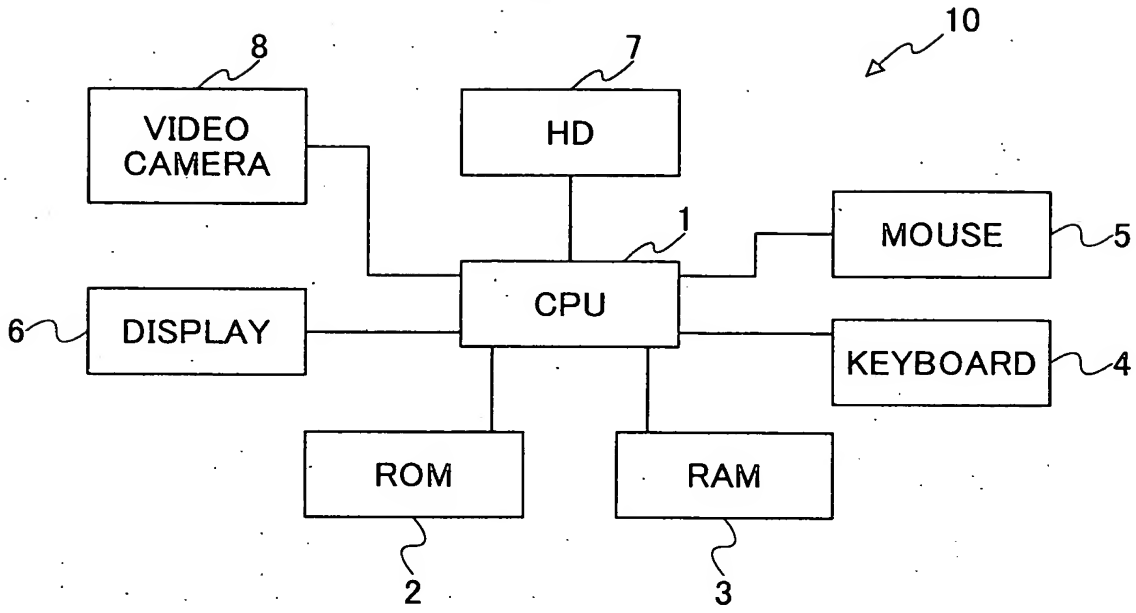

10
8
7
VIDEO CAMERA
HD
1
MOUSE
5
6
DISPLAY
CPU
KEYBOARD
4
ROM
RAM
2
3

FIG.2

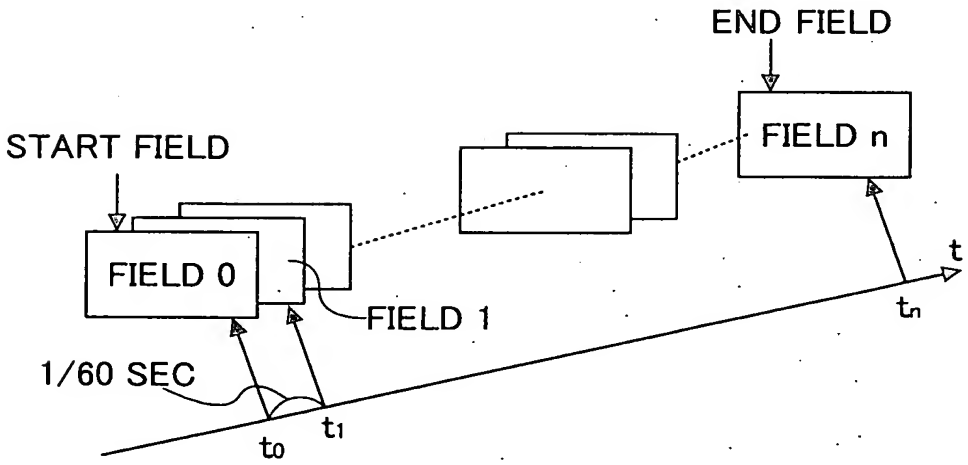
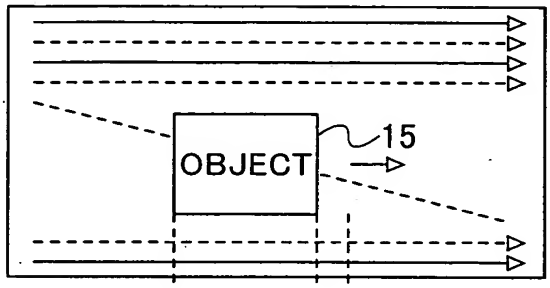

END FIELD
FIELD n
START FIELD
FIELD 0
FIELD 1
t
tn
1/60 SEC
t0
t1

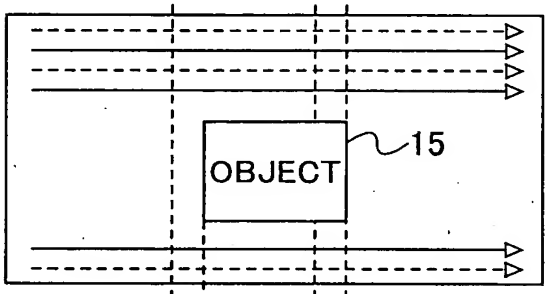
FIG.3A



INTERLACED IMAGE A

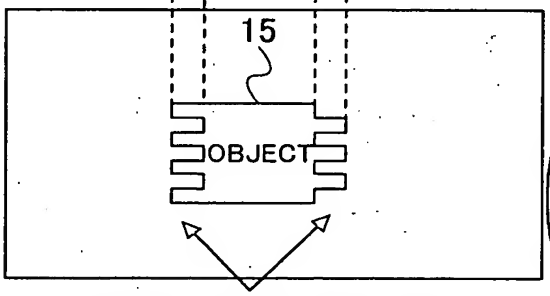
1/60 SEC LATER

FIG.3B



INTERLACED IMAGE B

FIG.3C

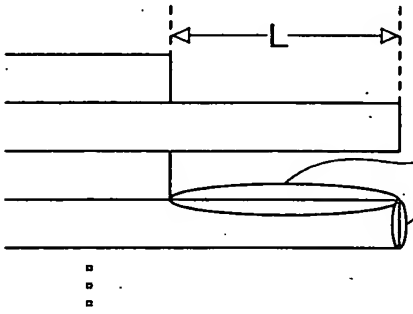


NON-INTERLACED IMAGE

(INTERLACED IMAGE A + INTERLACED IMAGE B)

COMB-SHAPED OFFSET

FIG.3D



HORIZONTAL EDGE COMPONENT (E1)

VERTICAL EDGE COMPONENT (E2)

FIG.4

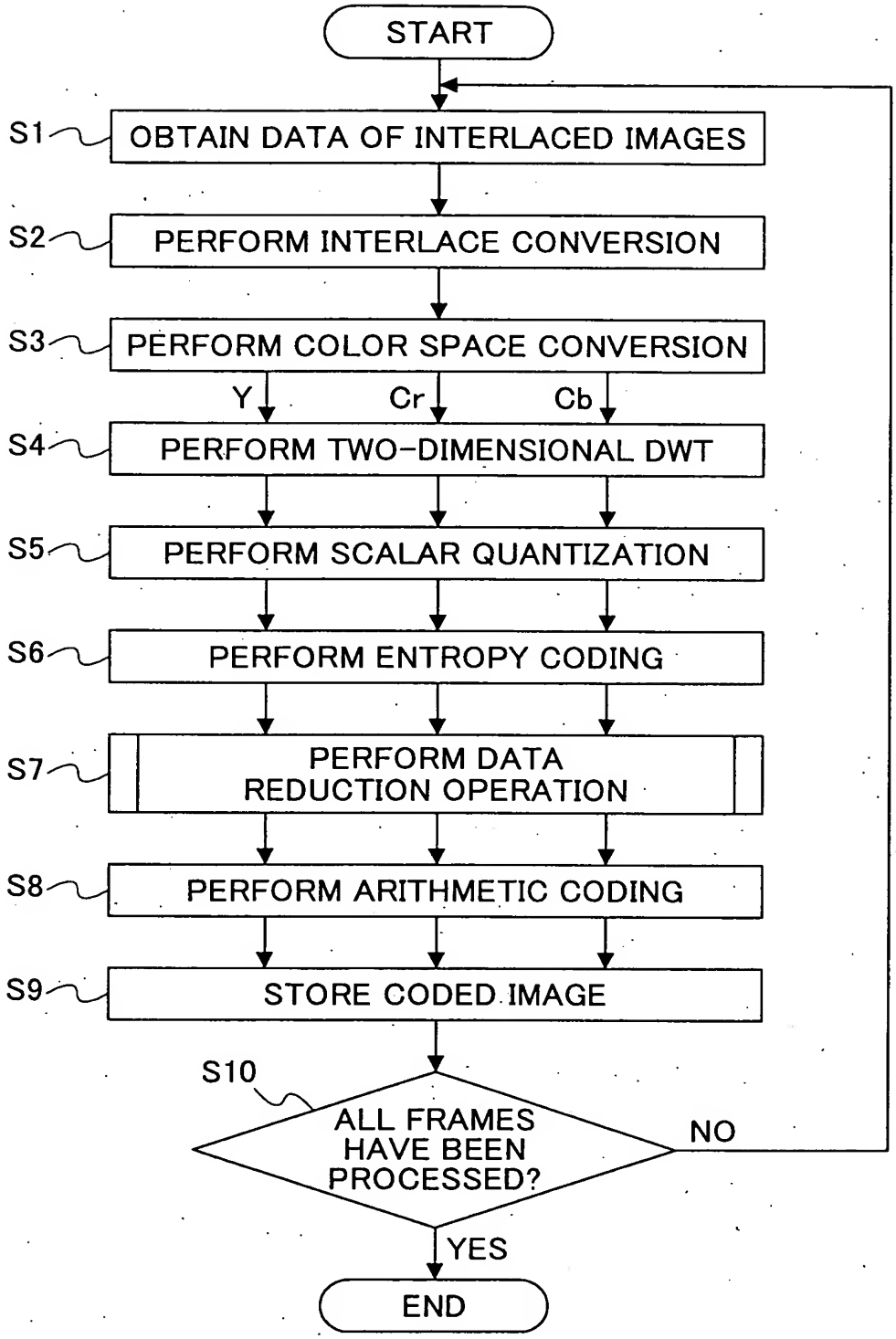

START
S1
OBTAIN DATA OF INTERLACED IMAGES
S2
PERFORM INTERLACE CONVERSION
S3
PERFORM COLOR SPACE CONVERSION
Y
Cr
Cb
S4
PERFORM TWO-DIMENSIONAL DWT
S5
PERFORM SCALAR QUANTIZATION
S6
PERFORM ENTROPY CODING
S7
PERFORM DATA REDUCTION OPERATION
S8
PERFORM ARITHMETIC CODING
S9
STORE CODED IMAGE
S10
ALL FRAMES HAVE BEEN PROCESSED?
NO
YES
END

FIG.5

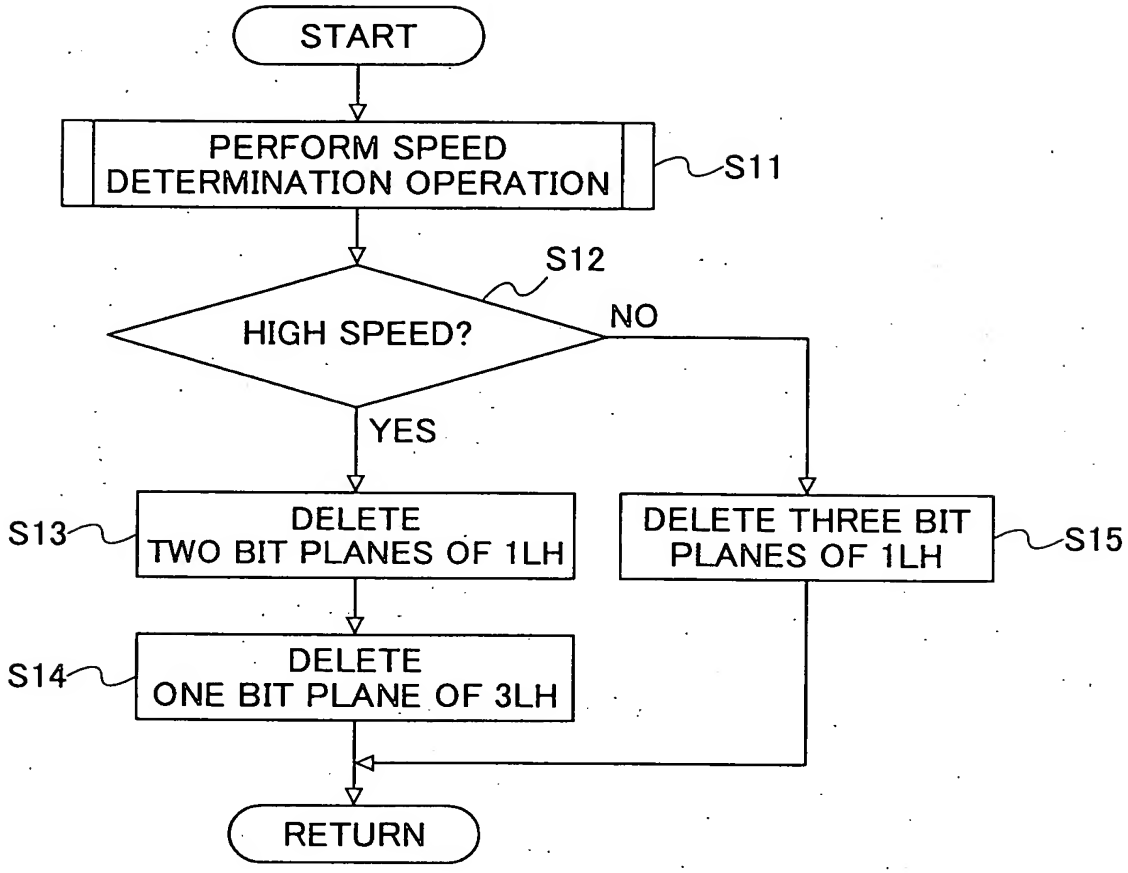

START
PERFORM SPEED DETERMINATION OPERATION
S11
S12
HIGH SPEED?
NO
YES
S13
DELETE TWO BIT PLANES OF 1LH
DELETE THREE BIT PLANES OF 1LH
S15
S14
DELETE ONE BIT PLANE OF 3LH
RETURN

FIG.6A

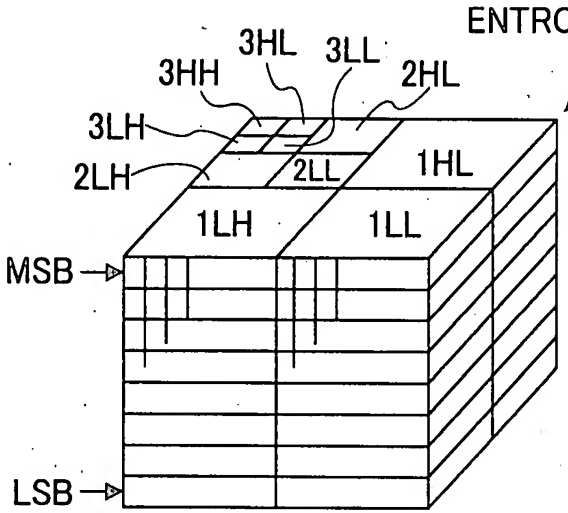


FIG.6B

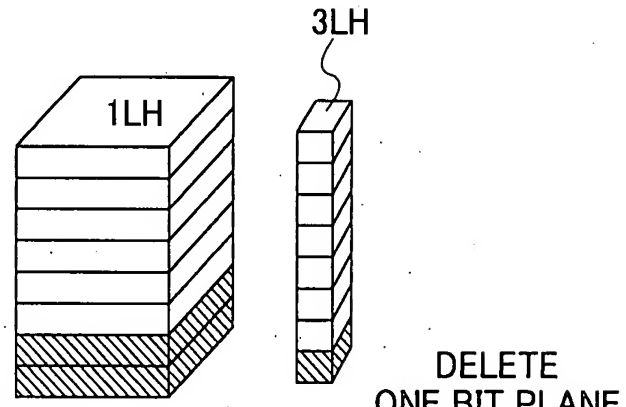


FIG.6C

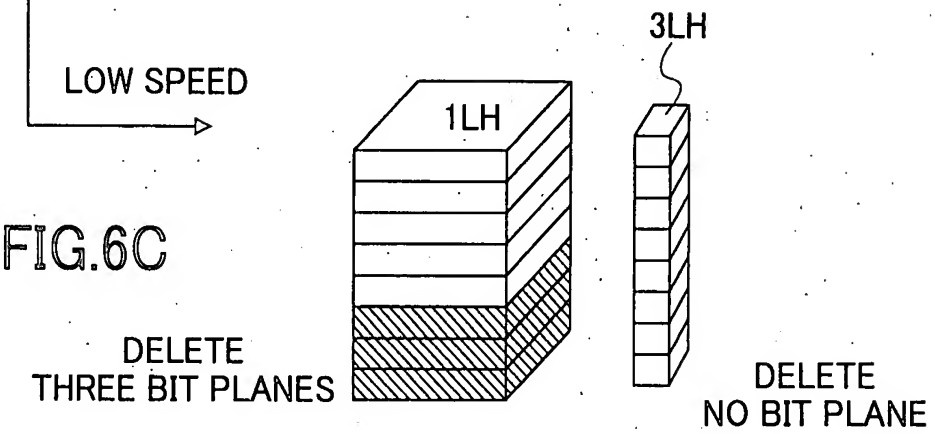


FIG.7

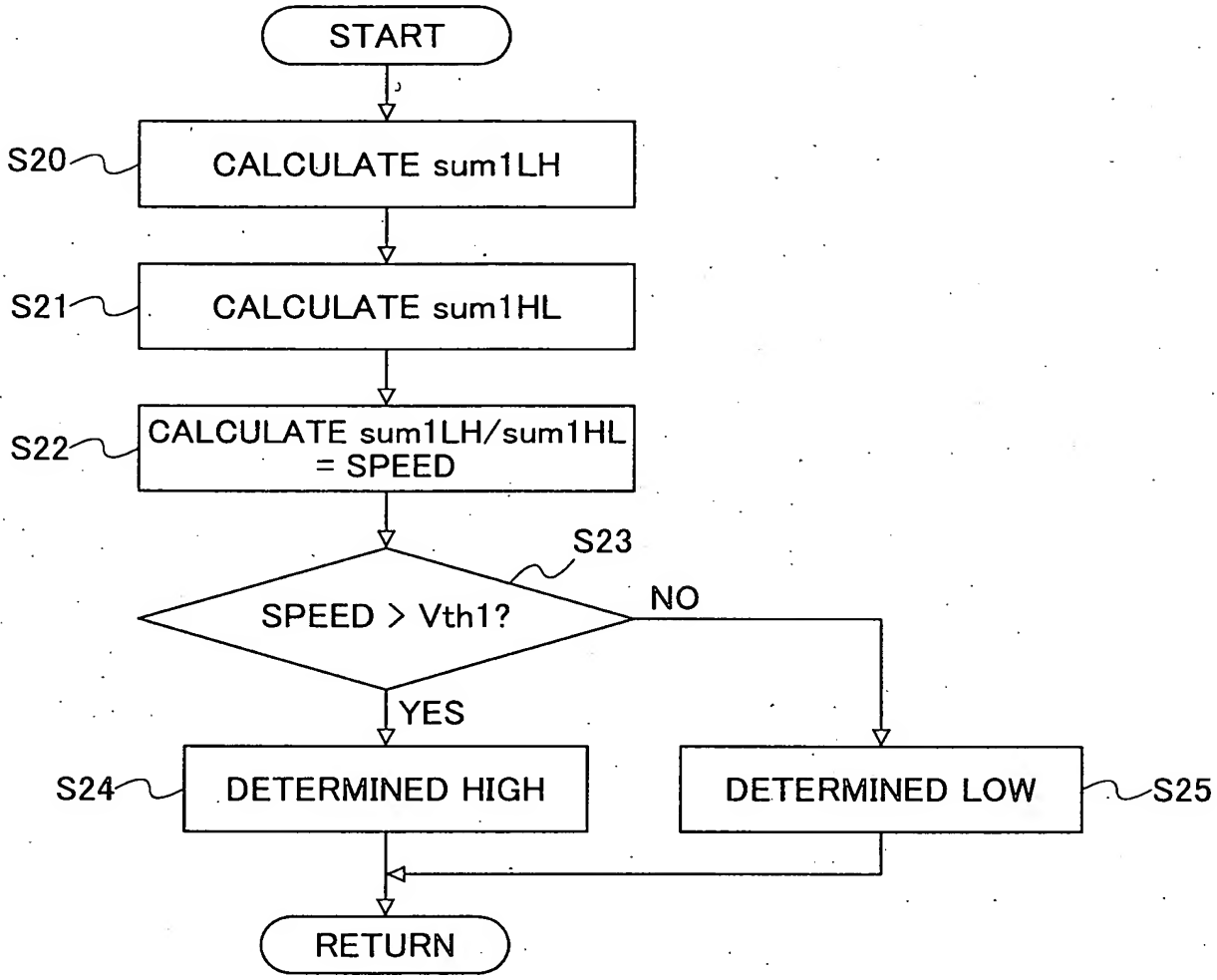

START
S20
CALCULATE sum1LH
S21
CALCULATE sum1HL
S22
CALCULATE sum1LH/sum1HL = SPEED
S23
SPEED > Vth1?
NO
YES
S24
DETERMINED HIGH
DETERMINED LOW
S25
RETURN

FIG.8

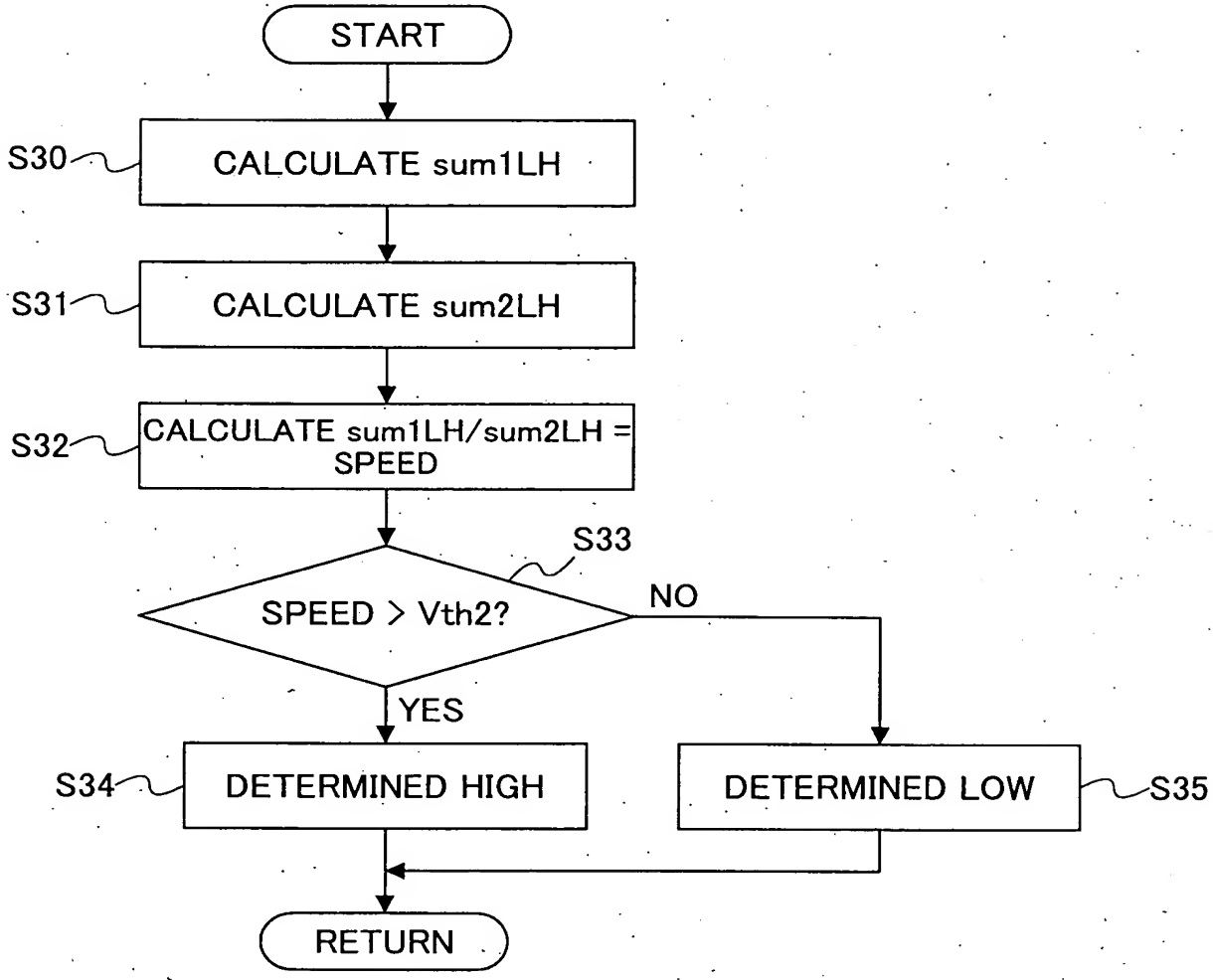

START
S30
CALCULATE sum1LH
S31
CALCULATE sum2LH
S32
CALCULATE sum1LH/sum2LH = SPEED
S33
SPEED > Vth2?
NO
YES
S34
DETERMINED HIGH
DETERMINED LOW
S35
RETURN

FIG.9

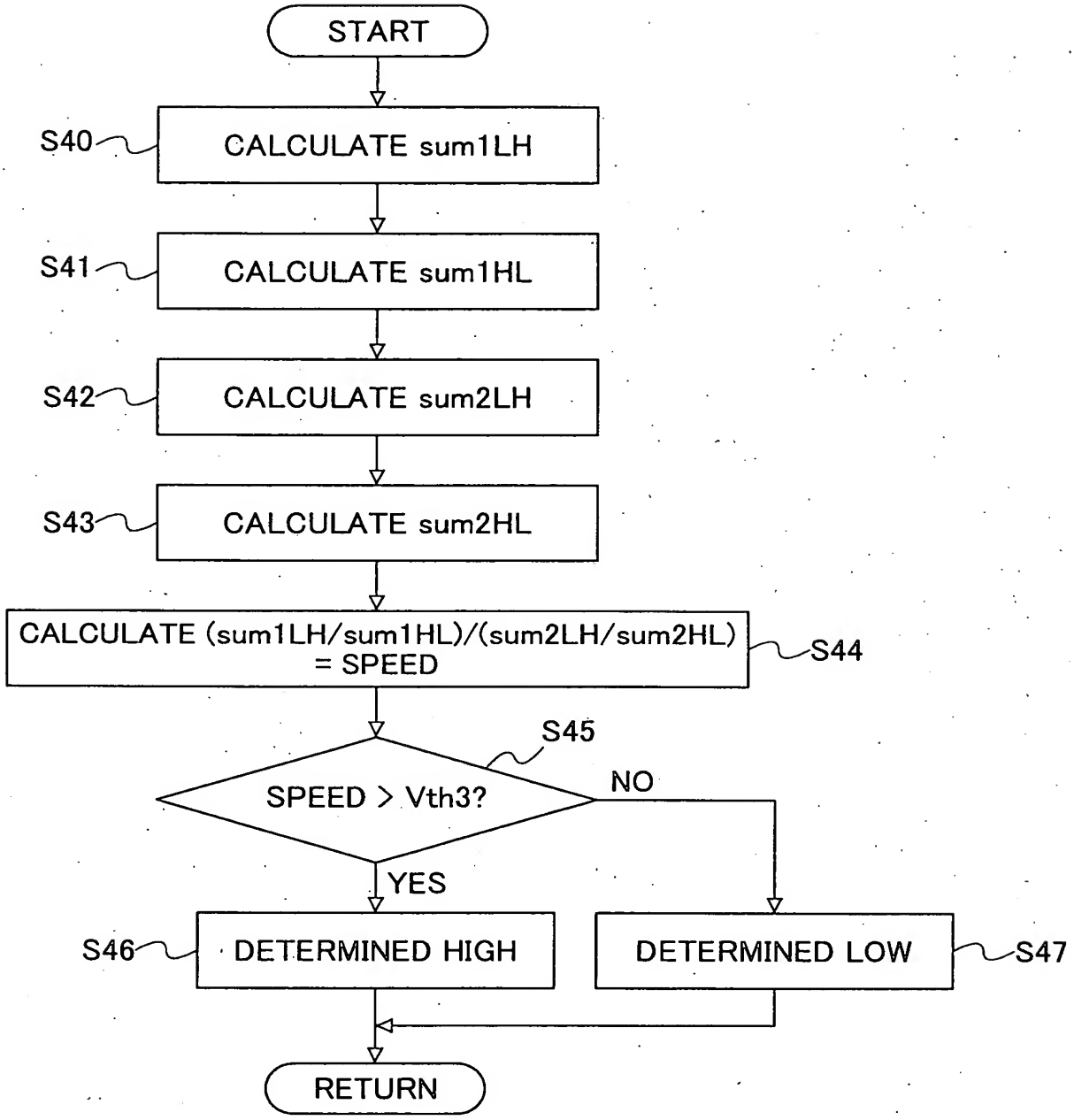

START
S40
CALCULATE sum1LH
S41
CALCULATE sum1HL
S42
CALCULATE sum2LH
S43
CALCULATE sum2HL
CALCULATE (sum1LH/sum1HL)/(sum2LH/sum2HL) = SPEED
S44
S45
SPEED > Vth3?
NO
YES
S46
DETERMINED HIGH
DETERMINED LOW
S47
RETURN

FIG.10

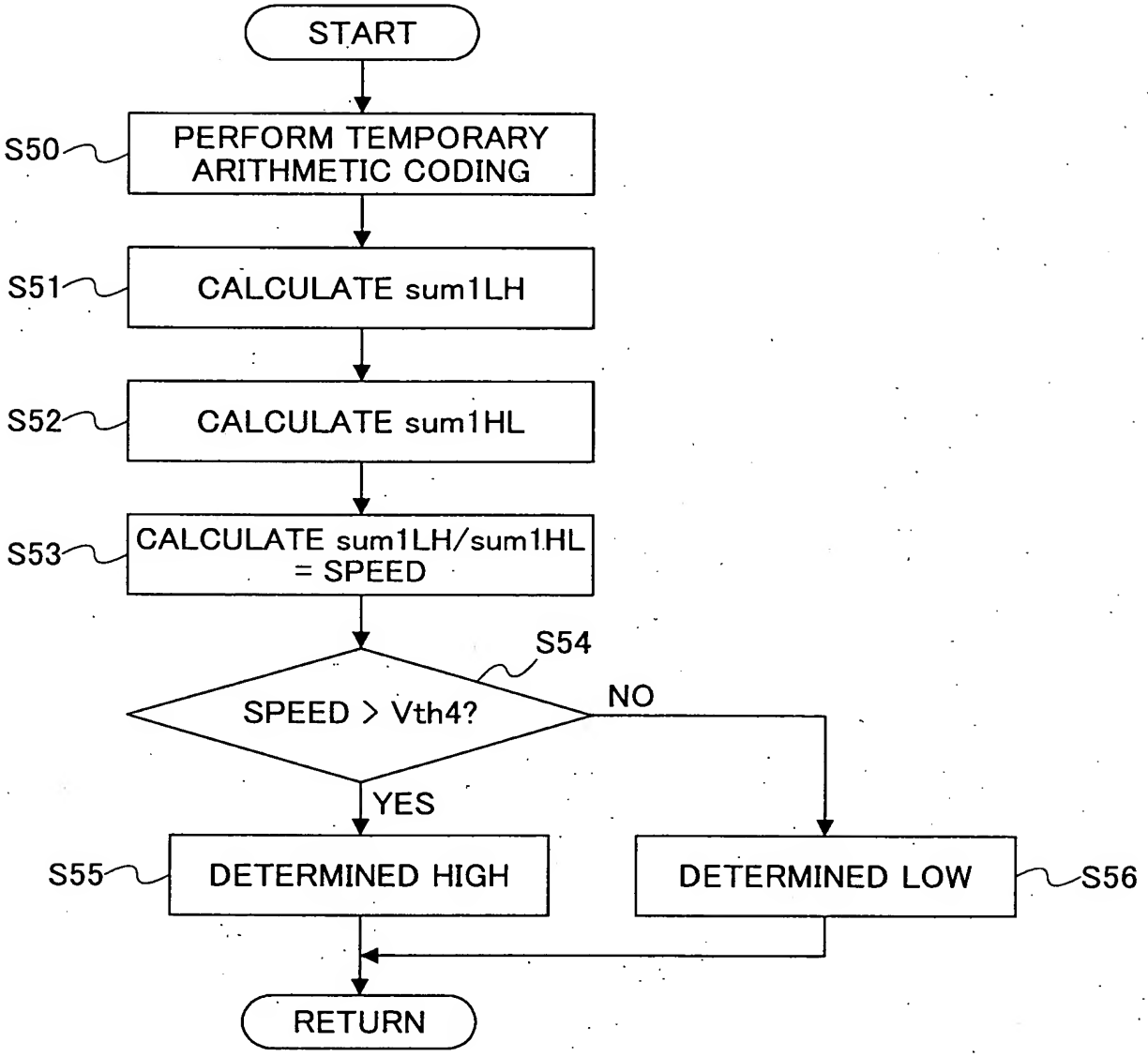

START
S50
PERFORM TEMPORARY ARITHMETIC CODING
S51
CALCULATE sum1LH
S52
CALCULATE sum1HL
S53
CALCULATE sum1LH/sum1HL = SPEED
S54
SPEED > Vth4?
NO
YES
S55
DETERMINED HIGH
DETERMINED LOW
S56
RETURN

FIG.11

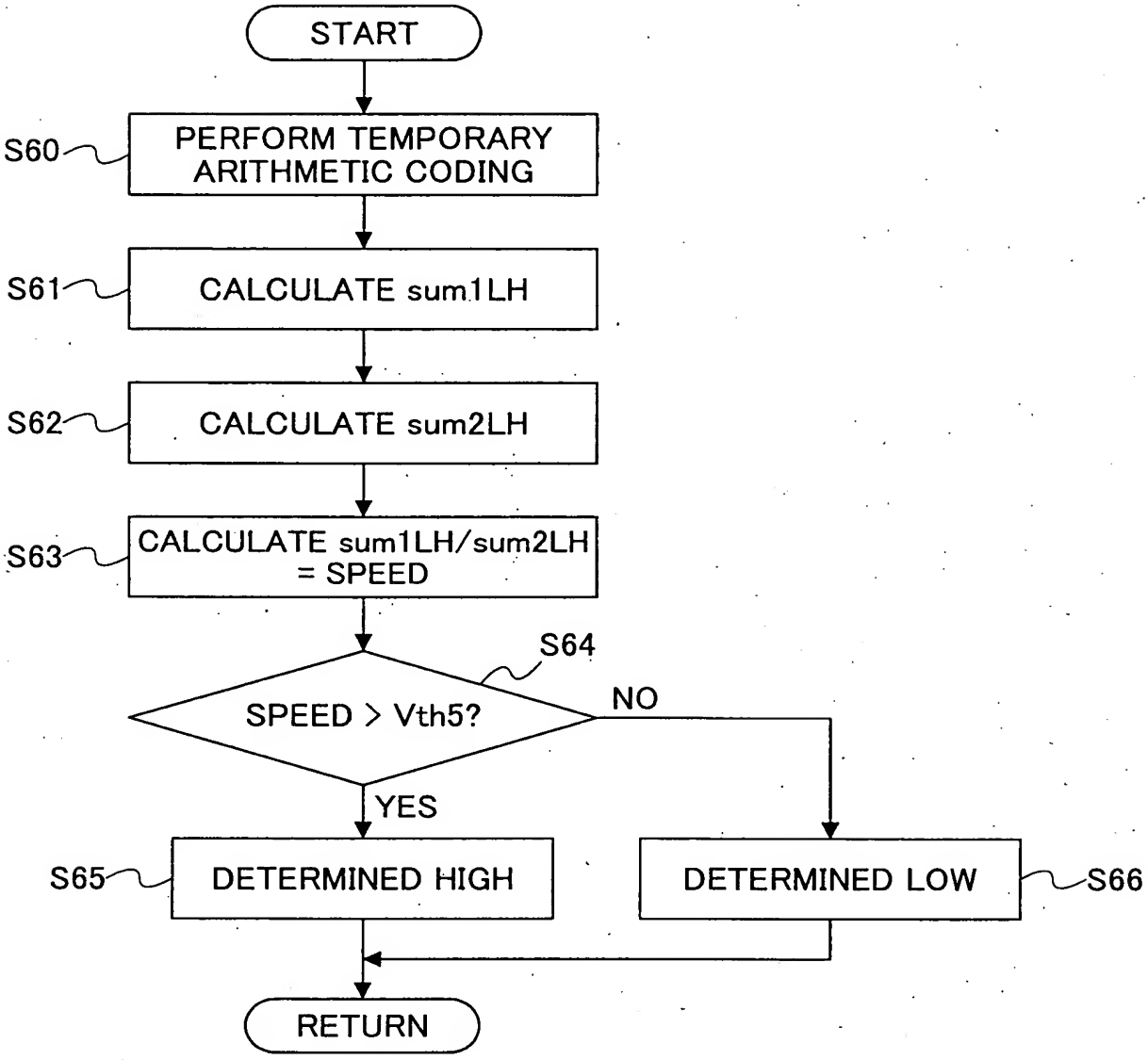

START
S60
PERFORM TEMPORARY ARITHMETIC CODING
S61
CALCULATE sum1LH
S62
CALCULATE sum2LH
S63
CALCULATE sum1LH/sum2LH = SPEED
S64
SPEED > Vth5?
NO
YES
S65
DETERMINED HIGH
DETERMINED LOW
S66
RETURN

FIG.12

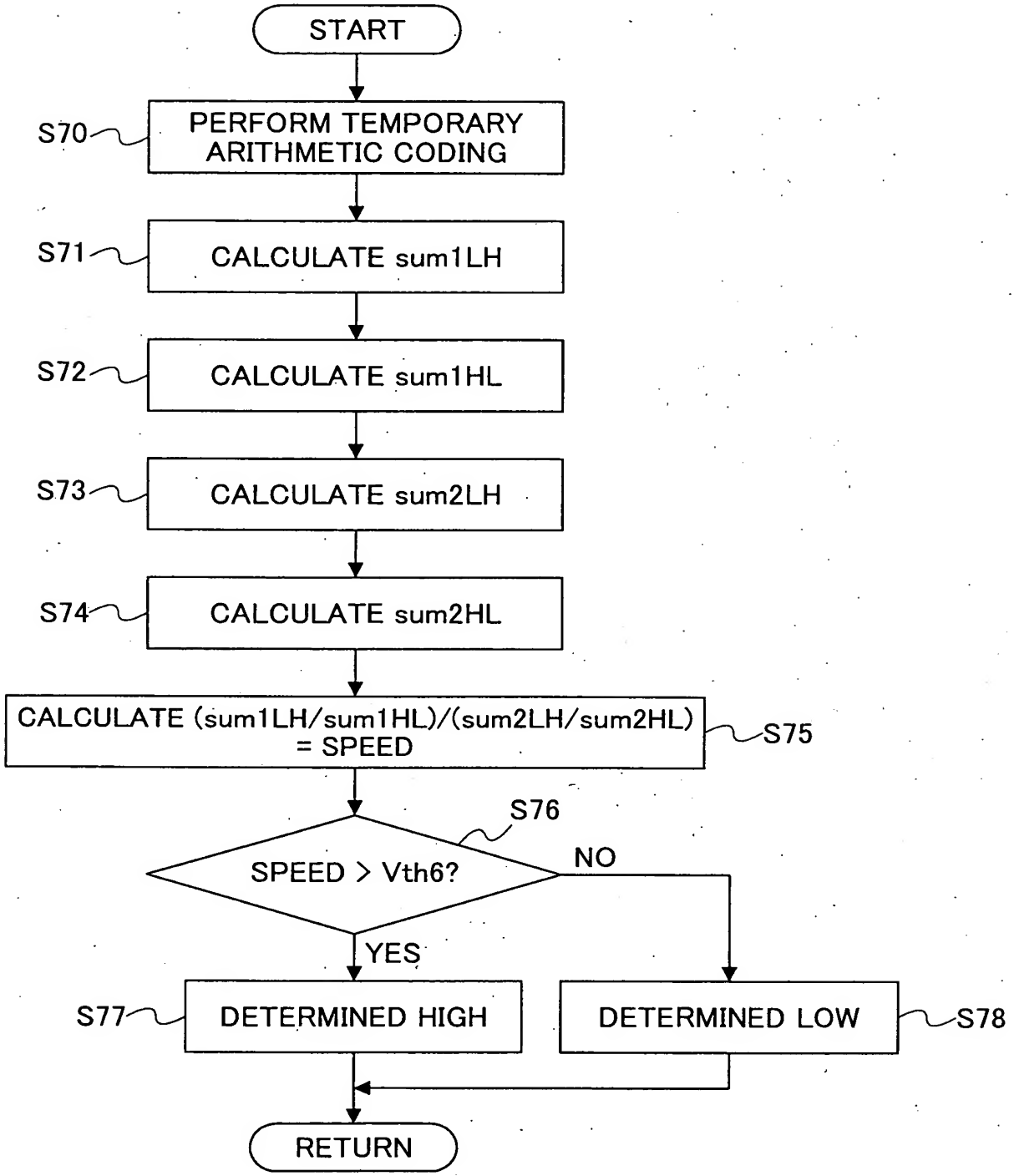

START
S70
PERFORM TEMPORARY ARITHMETIC CODING
S71
CALCULATE sum1LH
S72
CALCULATE sum1HL
S73
CALCULATE sum2LH
S74
CALCULATE sum2HL
CALCULATE (sum1LH/sum1HL)/(sum2LH/sum2HL) = SPEED
S75
S76
SPEED > Vth6?
NO
YES
S77
DETERMINED HIGH
DETERMINED LOW
S78
RETURN

FIG.13

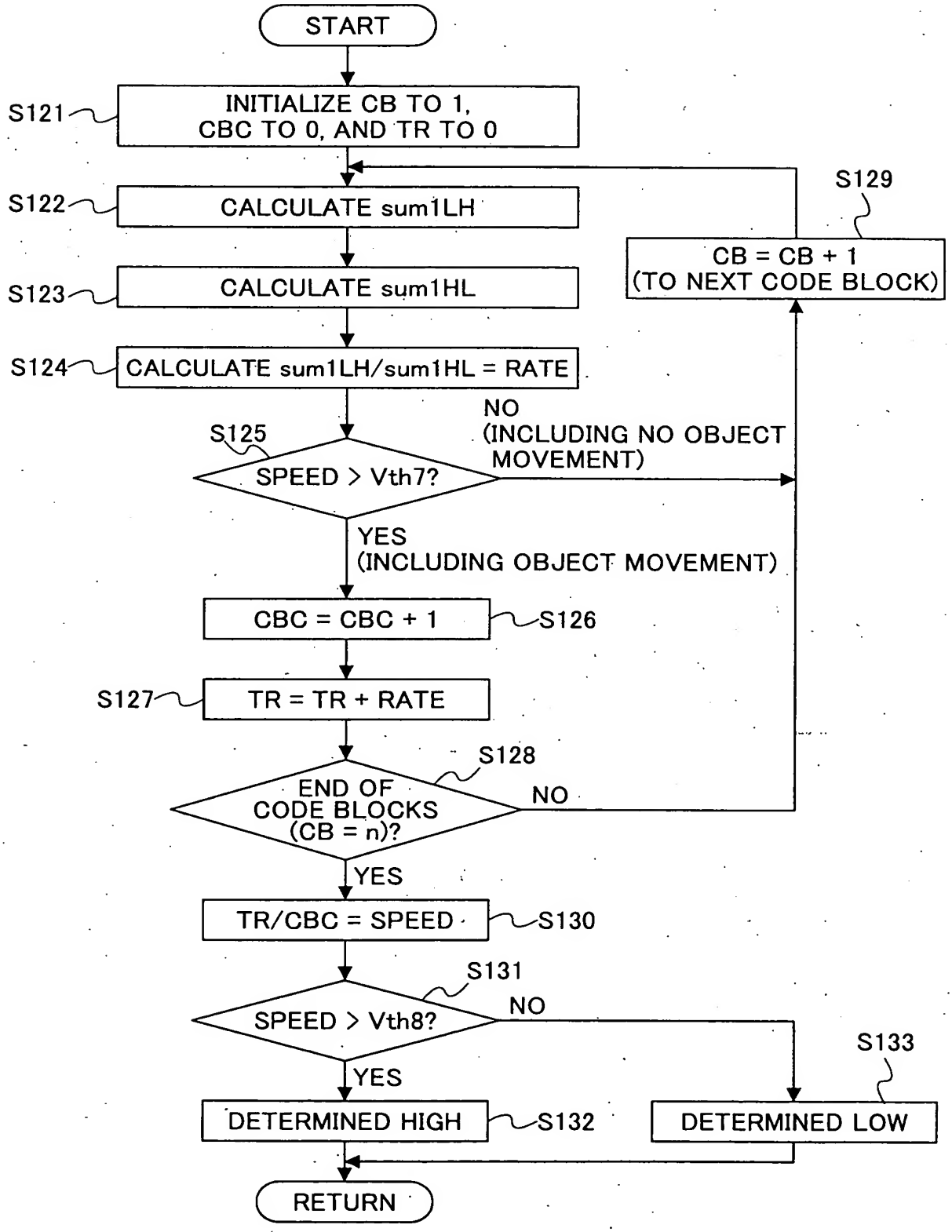

START
S121
INITIALIZE CB TO 1, CBC TO 0, AND TR TO 0
S122
CALCULATE sum1LH
S123
CALCULATE sum1HL
S124
CALCULATE sum1LH/sum1HL = RATE
S125
SPEED > Vth7?
NO (INCLUDING NO OBJECT MOVEMENT)
YES (INCLUDING OBJECT MOVEMENT)
CBC = CBC + 1
S126
S127
TR = TR + RATE
S128
END OF CODE BLOCKS (CB = n)?
NO
YES
S129
CB = CB + 1 (TO NEXT CODE BLOCK)
TR/CBC = SPEED
S130
S131
SPEED > Vth8?
NO
YES
S132
DETERMINED HIGH
S133
DETERMINED LOW
RETURN

FIG.14

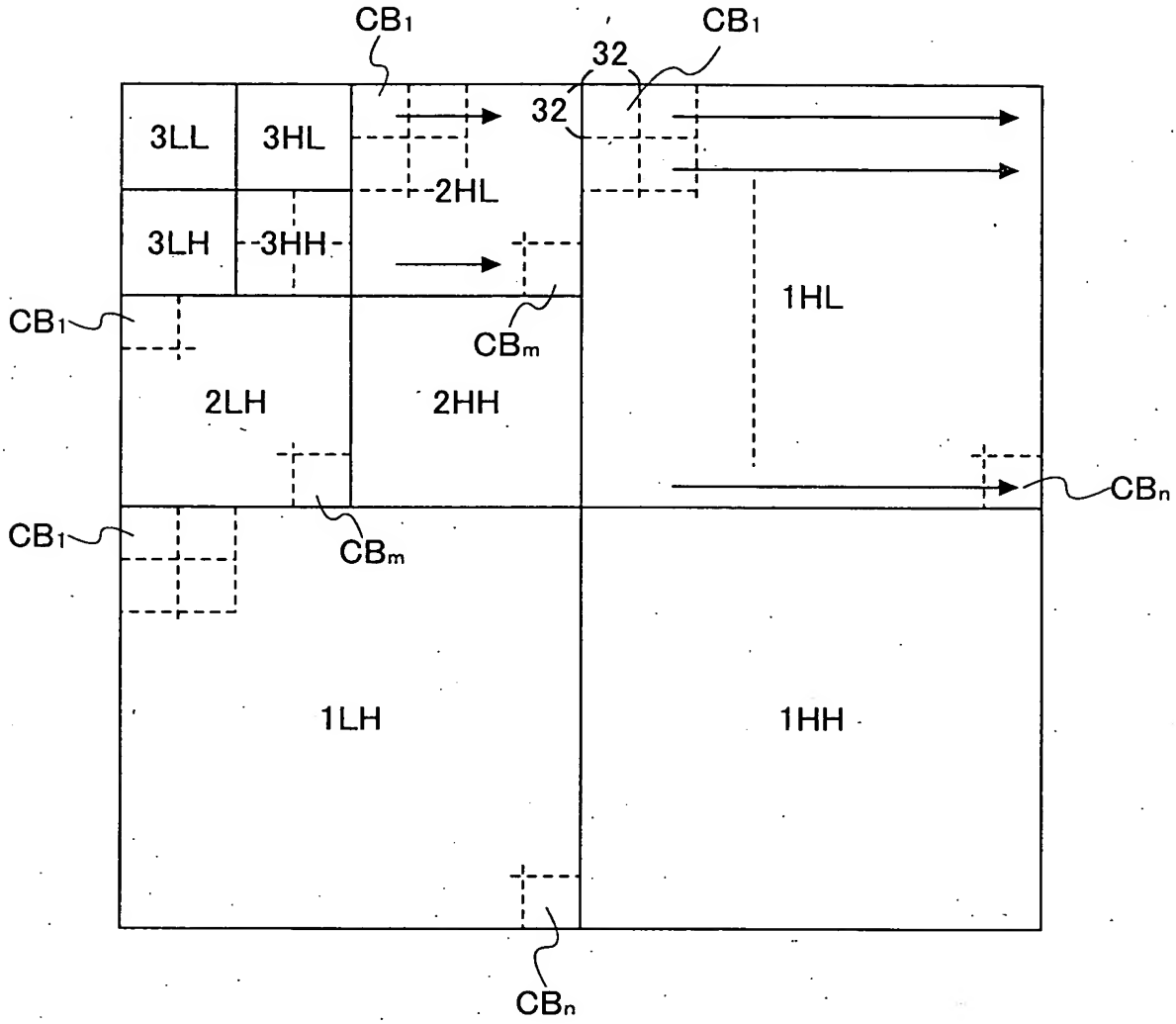

CB1
CB1
32
32
3LL
3HL
2HL
3LH
3HH
1HL
CB1
CBm
2LH
2HH
CBn
CB1
CBm
1LH
1HH
CBn

FIG.15

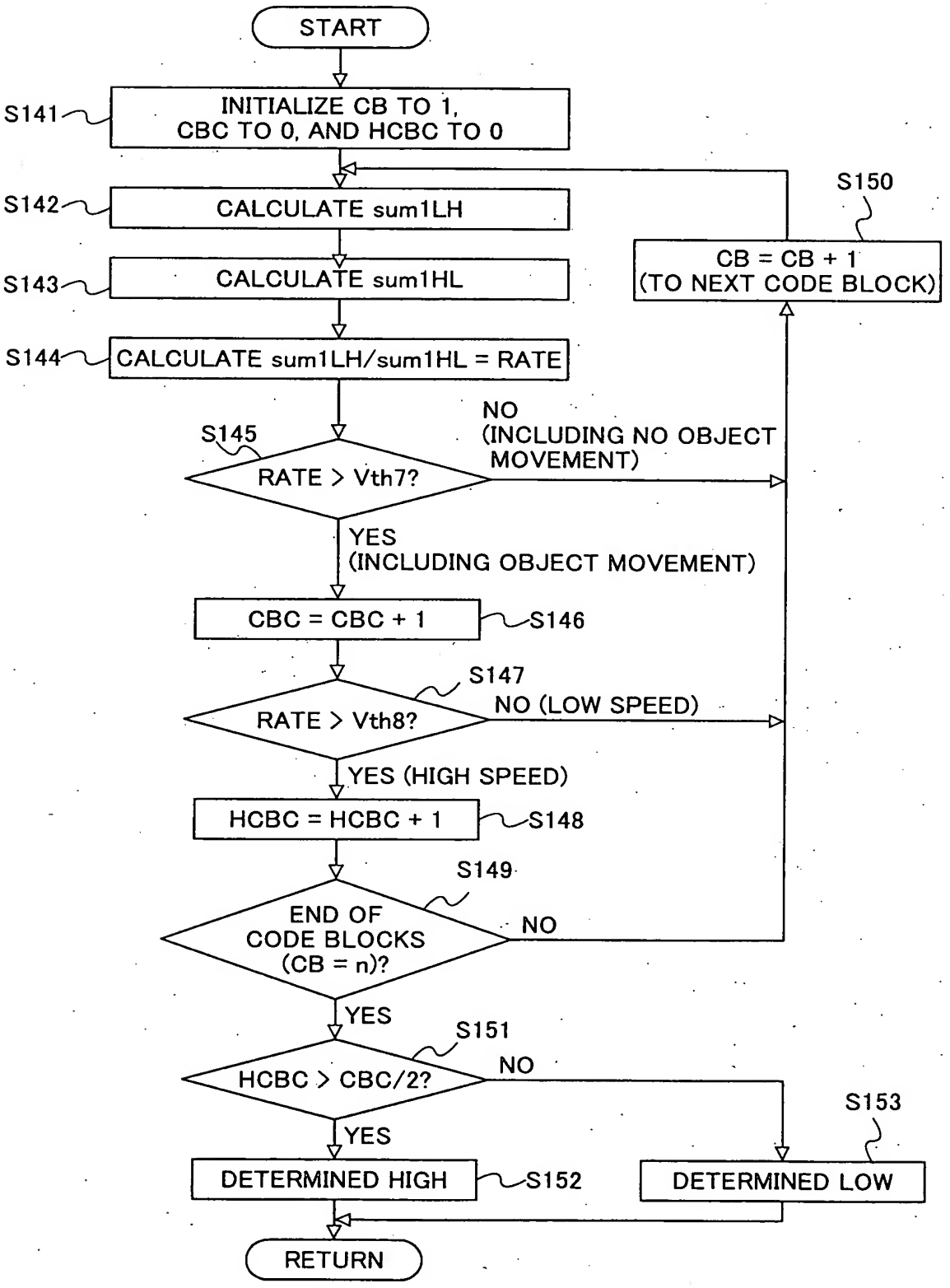

START
S141
INITIALIZE CB TO 1, CBC TO 0, AND HCBC TO 0
S142
CALCULATE sum1LH
S143
CALCULATE sum1HL
S144
CALCULATE sum1LH/sum1HL = RATE
S145
RATE > Vth7?
NO (INCLUDING NO OBJECT MOVEMENT)
YES (INCLUDING OBJECT MOVEMENT)
CBC = CBC + 1
S146
S147
RATE > Vth8?
NO (LOW SPEED)
YES (HIGH SPEED)
HCBC = HCBC + 1
S148
S149
END OF CODE BLOCKS (CB = n)?
NO
YES
S151
HCBC > CBC/2?
NO
YES
S150
CB = CB + 1 (TO NEXT CODE BLOCK)
S153
DETERMINED HIGH
S152
DETERMINED LOW
RETURN

FIG.16

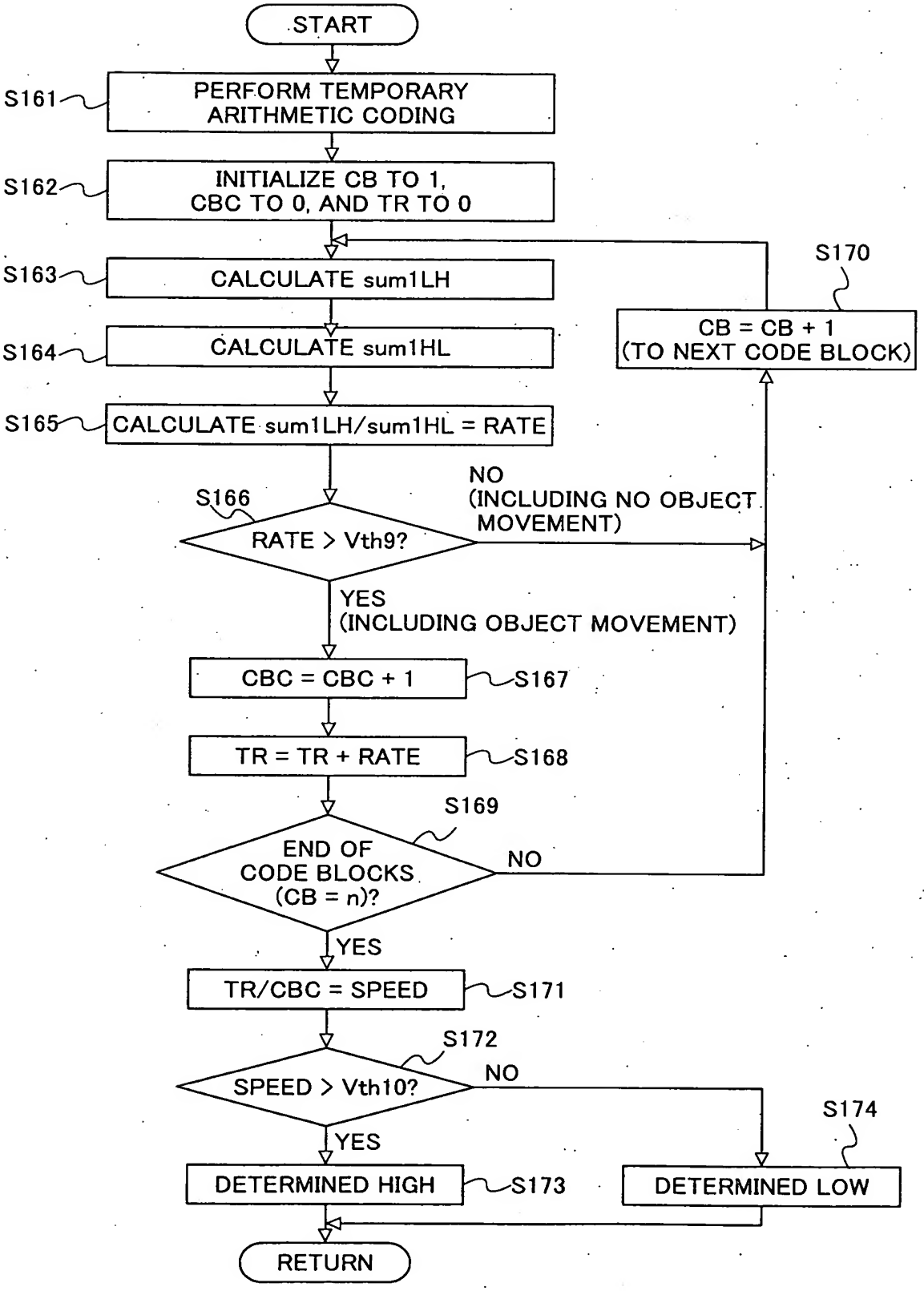

START
S161
PERFORM TEMPORARY ARITHMETIC CODING
S162
INITIALIZE CB TO 1, CBC TO 0, AND TR TO 0
S163
CALCULATE sum1LH
S164
CALCULATE sum1HL
S165
CALCULATE sum1LH/sum1HL = RATE
S166
RATE > Vth9?
NO (INCLUDING NO OBJECT MOVEMENT)
YES (INCLUDING OBJECT MOVEMENT)
CBC = CBC + 1
S167
TR = TR + RATE
S168
S169
END OF CODE BLOCKS (CB = n)?
NO
YES
TR/CBC = SPEED
S171
S172
SPEED > Vth10?
NO
YES
S174
DETERMINED HIGH
S173
DETERMINED LOW
RETURN
S170
CB = CB + 1 (TO NEXT CODE BLOCK)

FIG.17

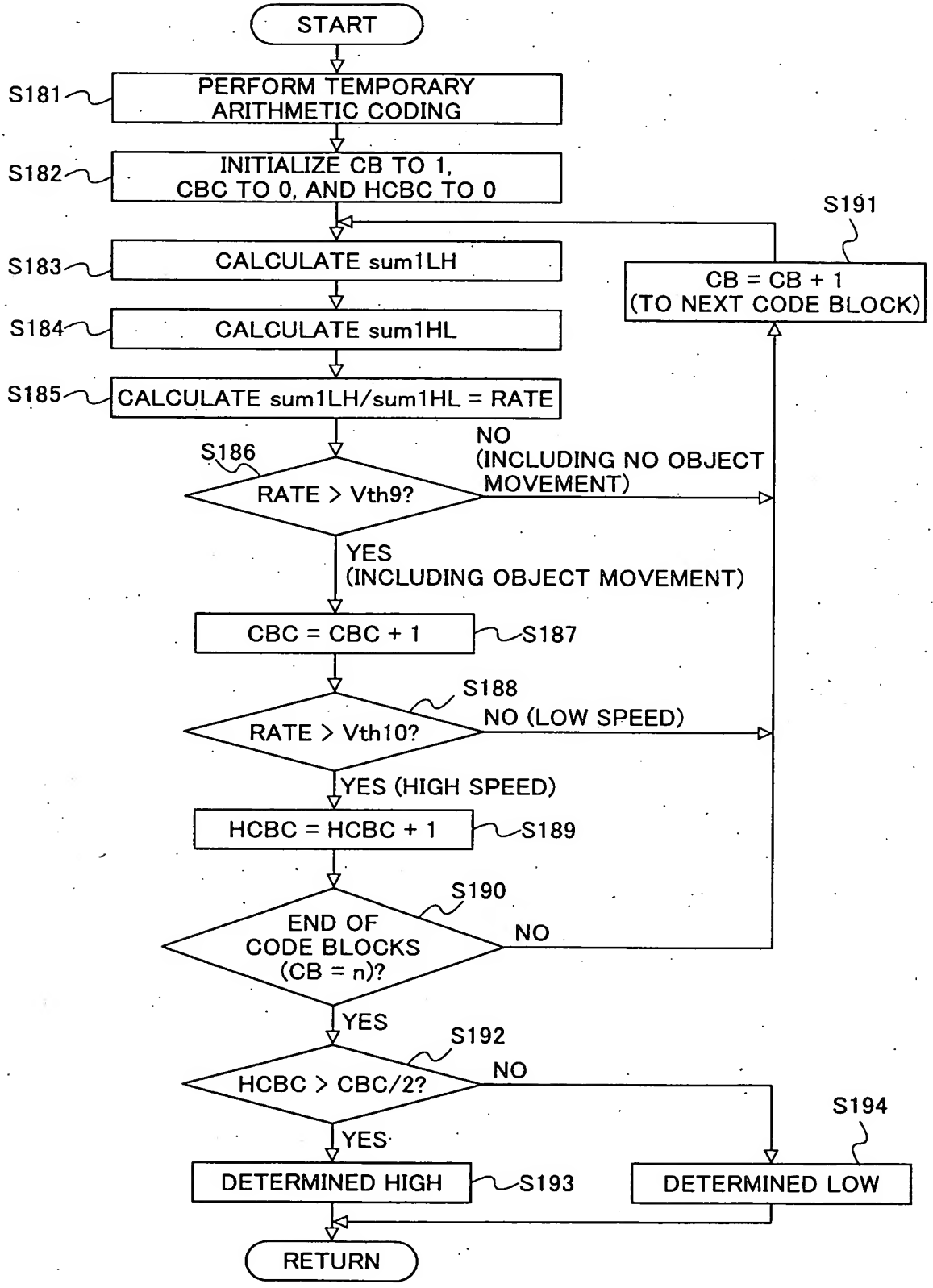

START
S181
PERFORM TEMPORARY ARITHMETIC CODING
S182
INITIALIZE CB TO 1, CBC TO 0, AND HCBC TO 0
S183
CALCULATE sum1LH
S184
CALCULATE sum1HL
S185
CALCULATE sum1LH/sum1HL = RATE
S186
RATE > Vth9?
NO (INCLUDING NO OBJECT MOVEMENT)
YES (INCLUDING OBJECT MOVEMENT)
CBC = CBC + 1
S187
S188
RATE > Vth10?
NO (LOW SPEED)
YES (HIGH SPEED)
HCBC = HCBC + 1
S189
S190
END OF CODE BLOCKS (CB = n)?
NO
YES
S191
CB = CB + 1 (TO NEXT CODE BLOCK)
S192
HCBC > CBC/2?
NO
YES
S193
DETERMINED HIGH
S194
DETERMINED LOW
RETURN

FIG.18

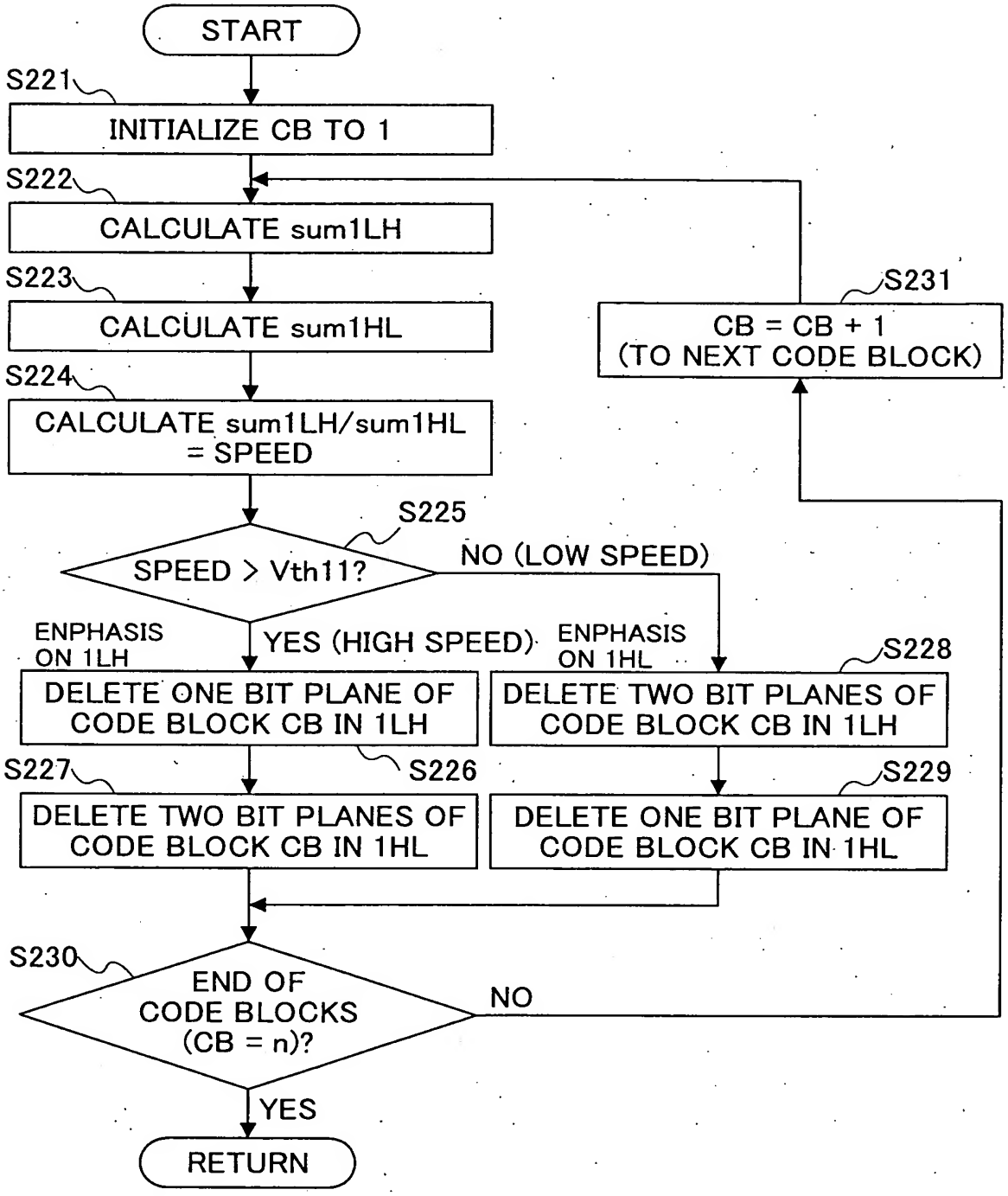

START
S221
INITIALIZE CB TO 1
S222
CALCULATE sum1LH
S223
CALCULATE sum1HL
S224
CALCULATE sum1LH/sum1HL = SPEED
S225
SPEED > Vth11?
NO (LOW SPEED)
YES (HIGH SPEED)
ENPHASIS ON 1LH
ENPHASIS ON 1HL
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1LH
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1LH
S226
S227
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1HL
S228
S229
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1HL
S230
END OF CODE BLOCKS (CB = n)?
NO
YES
RETURN
S231
CB = CB + 1 (TO NEXT CODE BLOCK)

FIG.19A

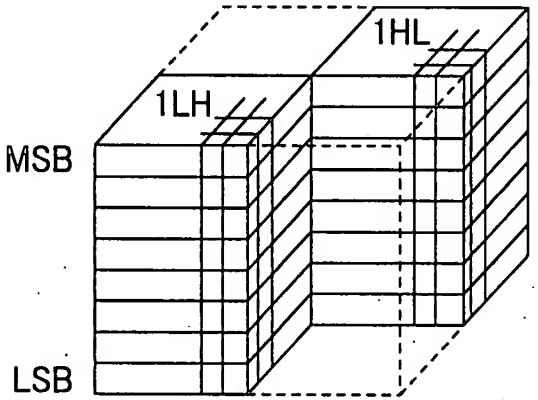
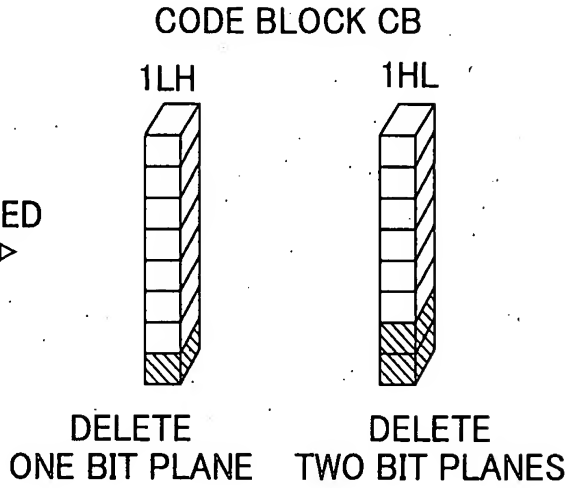


FIG.19B



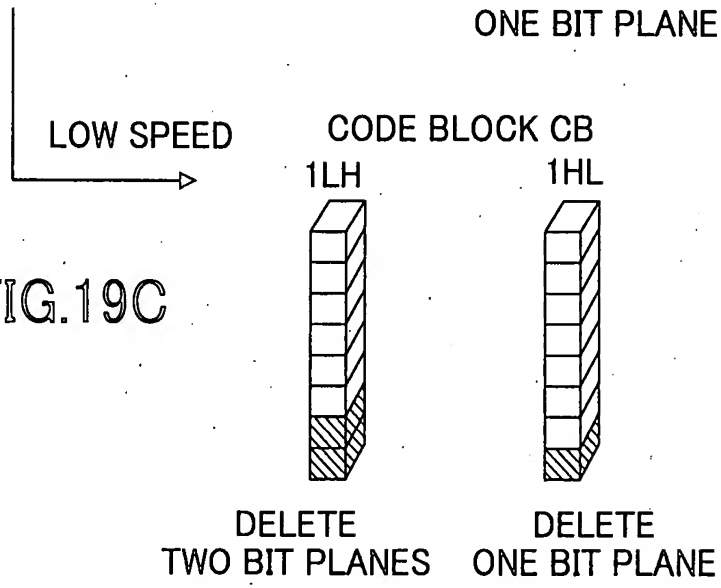


FIG.19C

FIG.20

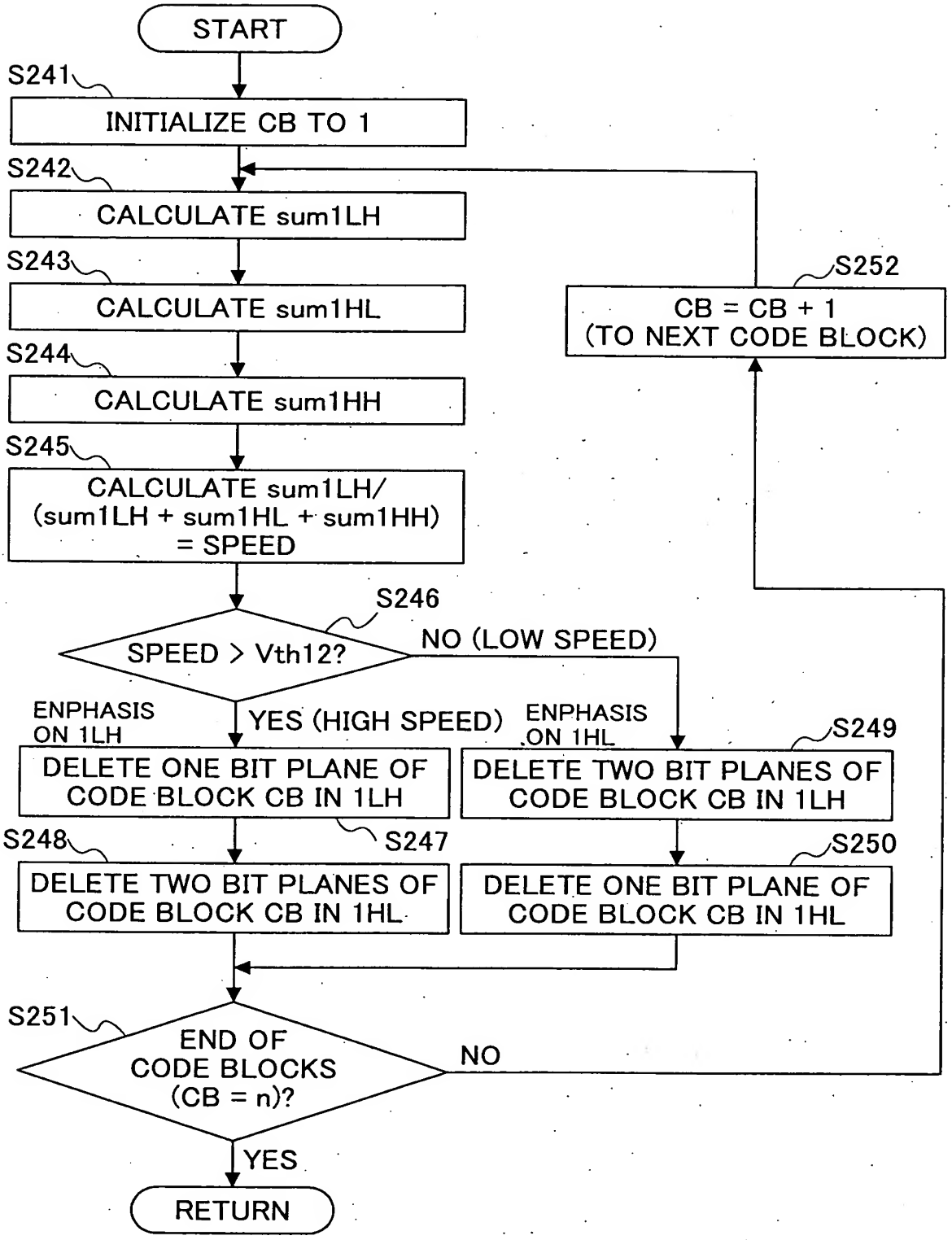

START
S241
INITIALIZE CB TO 1
S242
CALCULATE sum1LH
S243
CALCULATE sum1HL
S244
CALCULATE sum1HH
S245
CALCULATE sum1LH/
(sum1LH + sum1HL + sum1HH)
= SPEED
S246
SPEED > Vth12?
NO (LOW SPEED)
YES (HIGH SPEED)
ENPHASIS ON 1LH
ENPHASIS ON 1HL
S247
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1LH
S248
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1HL
S249
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1LH
S250
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1HL
S251
END OF CODE BLOCKS (CB = n)?
NO
YES
RETURN
S252
CB = CB + 1
(TO NEXT CODE BLOCK)

FIG.21

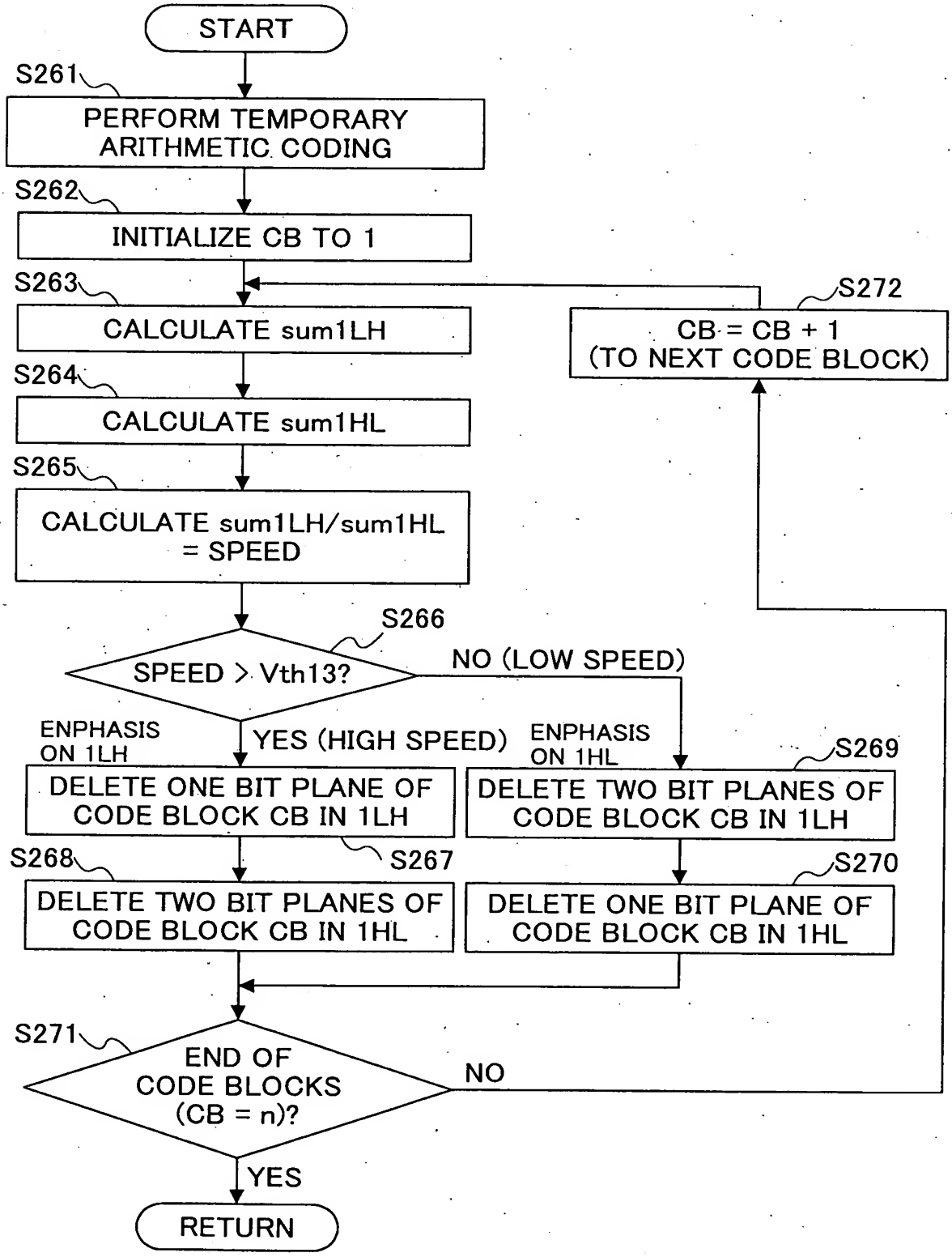

START
S261
PERFORM TEMPORARY ARITHMETIC CODING
S262
INITIALIZE CB TO 1
S263
CALCULATE sum1LH
S264
CALCULATE sum1HL
S265
CALCULATE sum1LH/sum1HL = SPEED
S266
SPEED > Vth13?
NO (LOW SPEED)
YES (HIGH SPEED)
ENPHASIS ON 1LH
ENPHASIS ON 1HL
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1LH
S267
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1LH
S269
S268
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1HL
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1HL
S270
S271
END OF CODE BLOCKS (CB = n)?
NO
YES
RETURN
S272
CB = CB + 1 (TO NEXT CODE BLOCK)

FIG.22

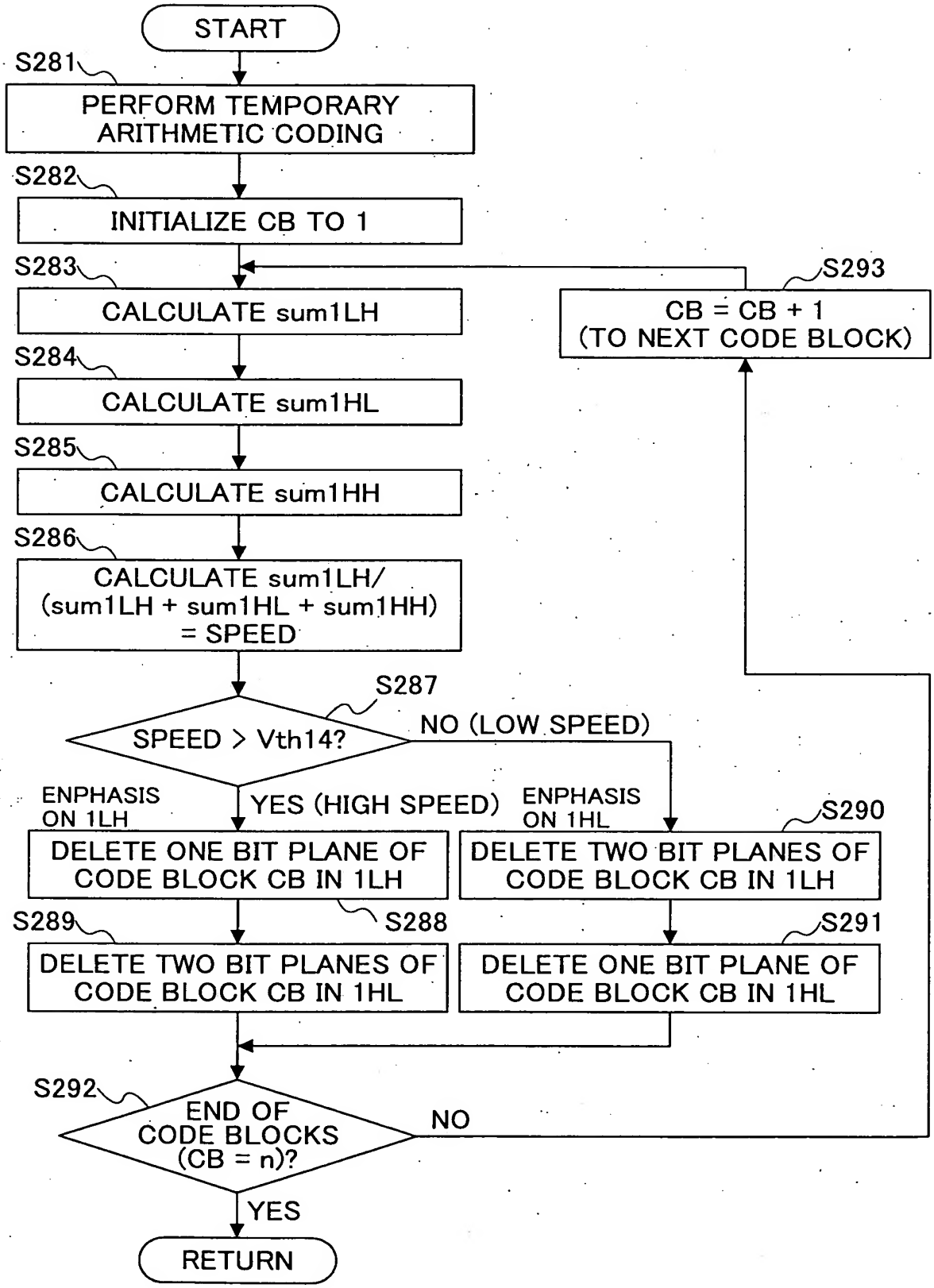

START
S281
PERFORM TEMPORARY ARITHMETIC CODING
S282
INITIALIZE CB TO 1
S283
CALCULATE sum1LH
S284
CALCULATE sum1HL
S285
CALCULATE sum1HH
S286
CALCULATE sum1LH/ (sum1LH + sum1HL + sum1HH) = SPEED
S287
SPEED > Vth14?
NO (LOW SPEED)
YES (HIGH SPEED)
ENPHASIS ON 1LH
ENPHASIS ON 1HL
S290
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1LH
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1LH
S288
S289
DELETE TWO BIT PLANES OF CODE BLOCK CB IN 1HL
S291
DELETE ONE BIT PLANE OF CODE BLOCK CB IN 1HL
S292
END OF CODE BLOCKS (CB = n)?
NO
YES
RETURN
S293
CB = CB + 1 (TO NEXT CODE BLOCK)

FIG.23

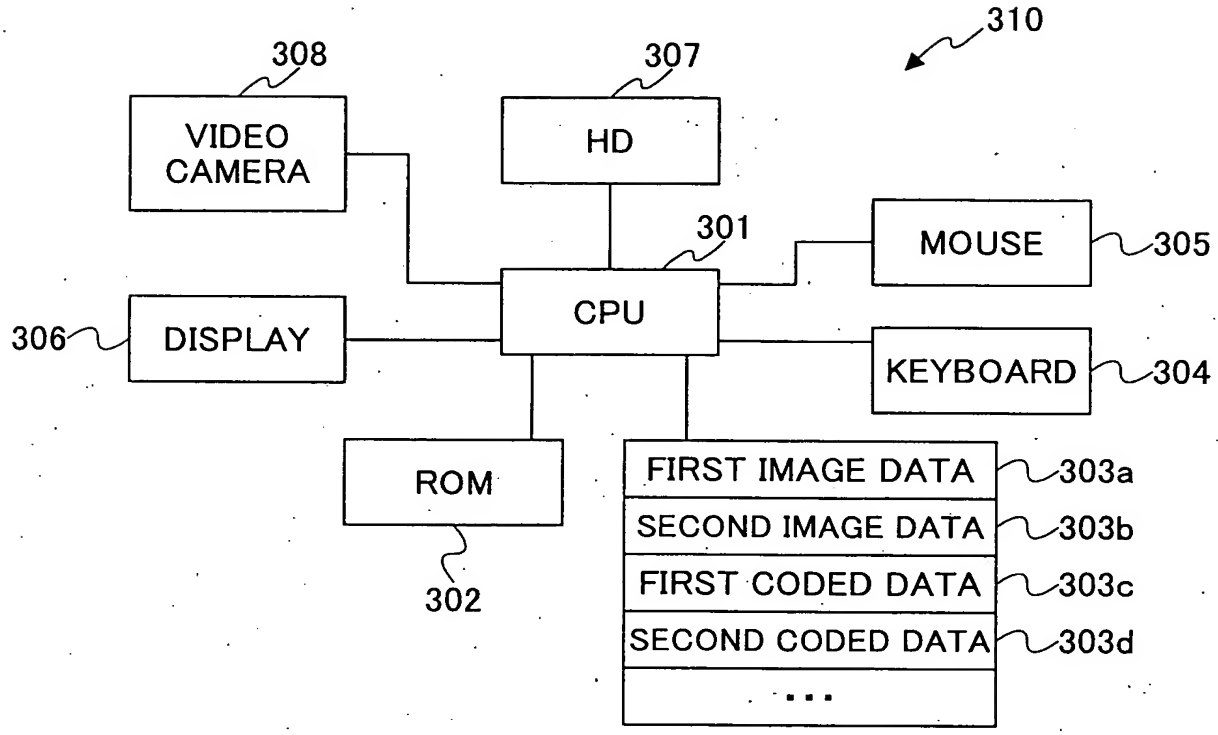

310
308
VIDEO CAMERA
307
HD
301
CPU
MOUSE
305
306
DISPLAY
KEYBOARD
304
ROM
302
FIRST IMAGE DATA
303a
SECOND IMAGE DATA
303b
FIRST CODED DATA
303c
SECOND CODED DATA
303d
...

FIG.24

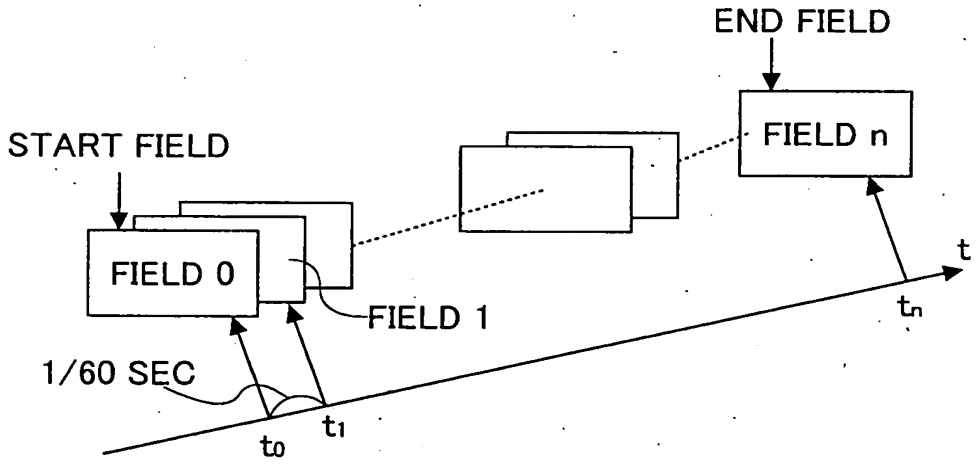
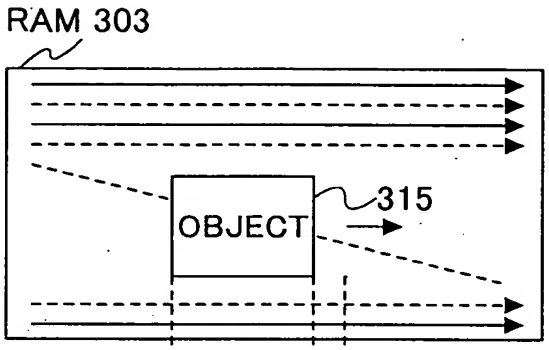

END FIELD
FIELD n
START FIELD
FIELD 0
FIELD 1
t
tn
1/60 SEC
t0
t1

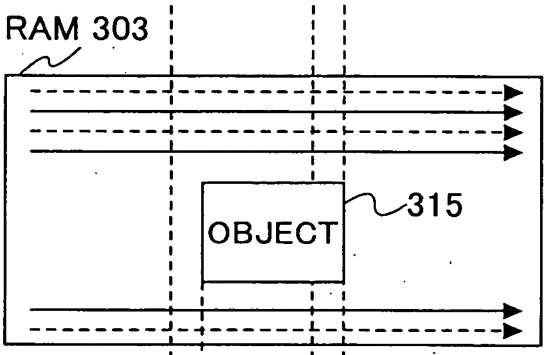
FIG.25A



WRITING DATA OF INTERLACE IMAGE A (FIELD)

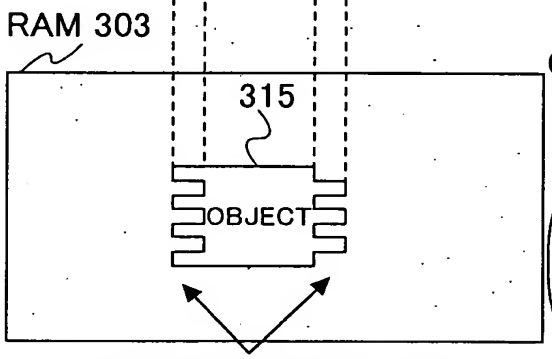
1/60 SEC LATER

FIG.25B



WRITING DATA OF INTERLACE IMAGE B (FIELD)

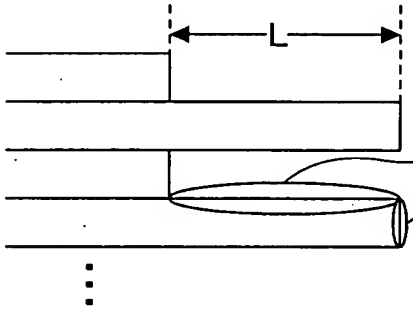
FIG.25C



COMPLETION OF DATA OF NON-INTERLACED IMAGE (FRAME)
(INTERLACED IMAGE A + INTERLACED IMAGE B)

COMB-SHAPED OFFSET

FIG.25D



HORIZONTAL EDGE COMPONENT (E1)

VERTICAL EDGE COMPONENT (E2)

FIG.26

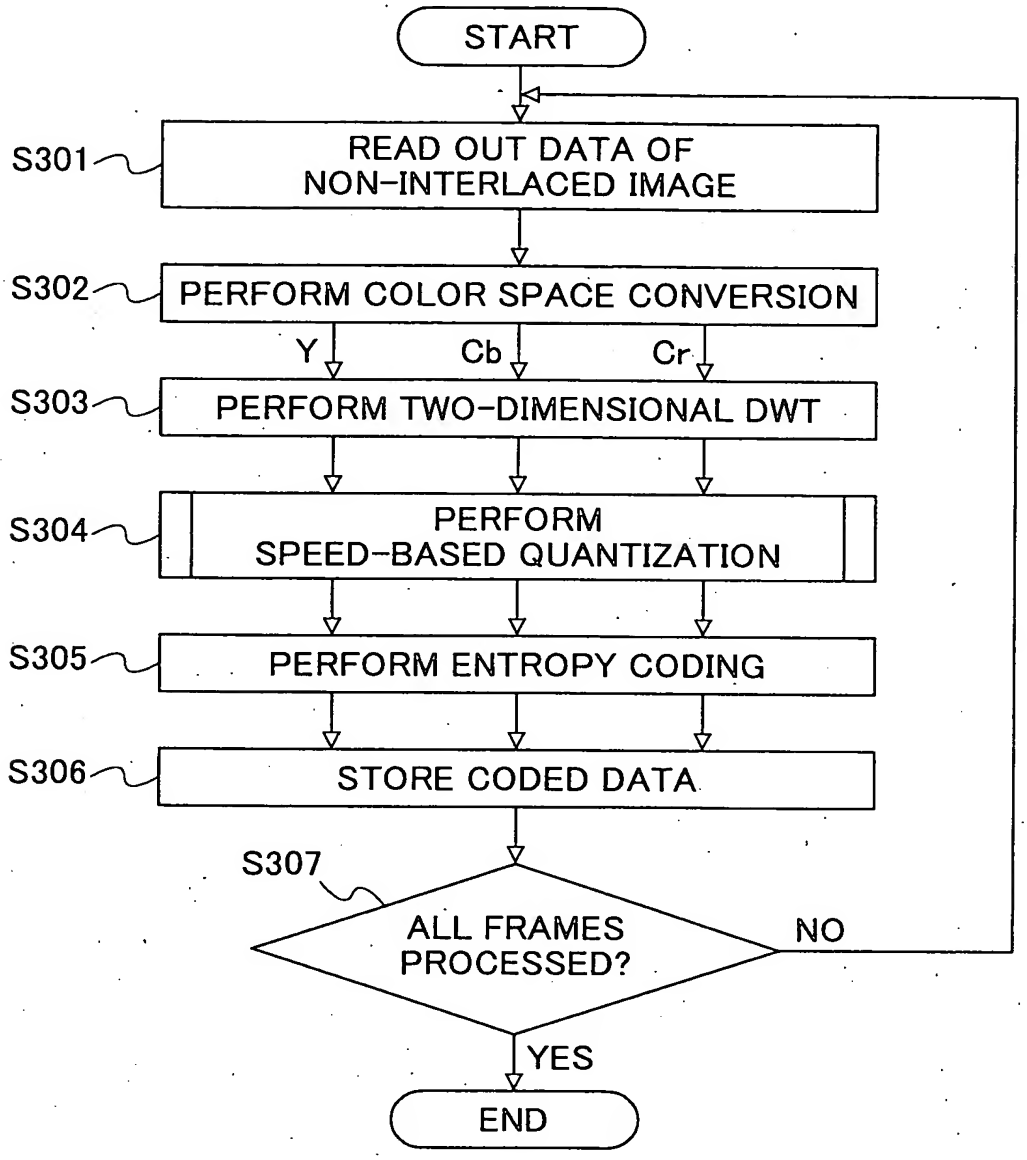

START
S301
READ OUT DATA OF NON-INTERLACED IMAGE
S302
PERFORM COLOR SPACE CONVERSION
Y
Cb
Cr
S303
PERFORM TWO-DIMENSIONAL DWT
S304
PERFORM SPEED-BASED QUANTIZATION
S305
PERFORM ENTROPY CODING
S306
STORE CODED DATA
S307
ALL FRAMES PROCESSED?
NO
YES
END

FIG.27

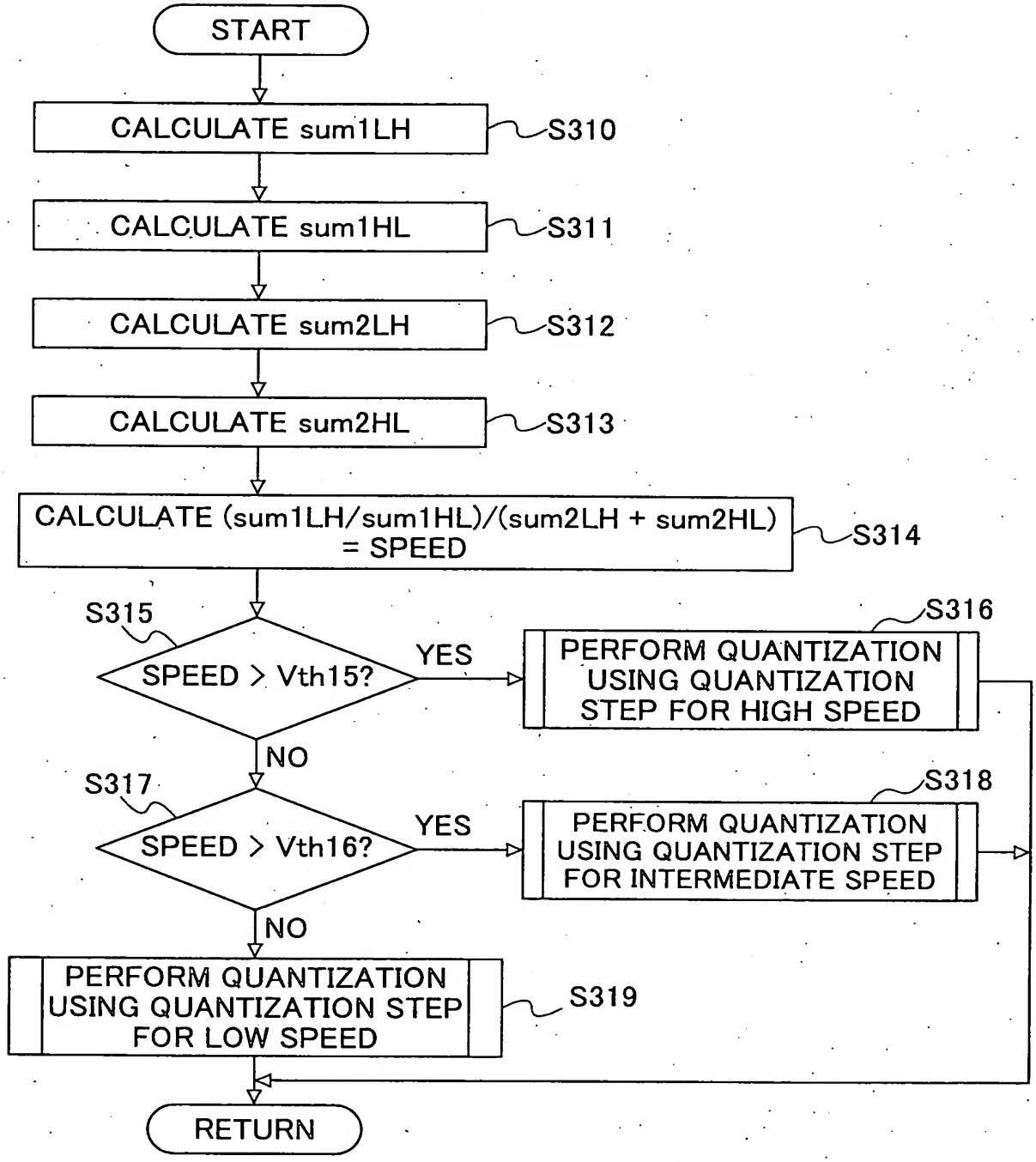

START
CALCULATE sum1LH
S310
CALCULATE sum1HL
S311
CALCULATE sum2LH
S312
CALCULATE sum2HL
S313
CALCULATE (sum1LH/sum1HL)/(sum2LH + sum2HL) = SPEED
S314
S315
SPEED > Vth15?
YES
S316
PERFORM QUANTIZATION USING QUANTIZATION STEP FOR HIGH SPEED
NO
S317
SPEED > Vth16?
YES
S318
PERFORM QUANTIZATION USING QUANTIZATION STEP FOR INTERMEDIATE SPEED
NO
PERFORM QUANTIZATION USING QUANTIZATION STEP FOR LOW SPEED
S319
RETURN

FIG.28

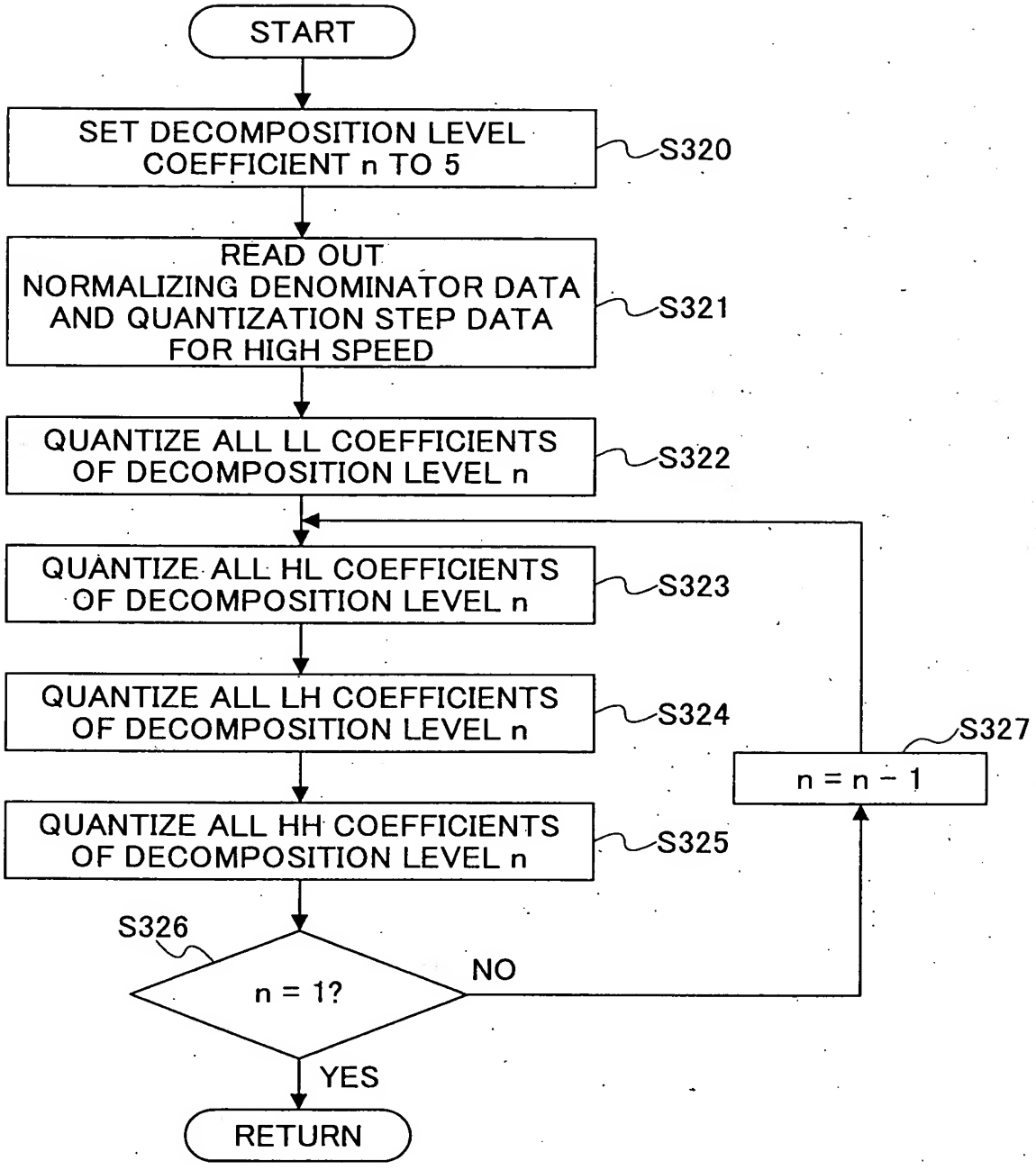

START
SET DECOMPOSITION LEVEL COEFFICIENT n TO 5
S320
READ OUT NORMALIZING DENOMINATOR DATA AND QUANTIZATION STEP DATA FOR HIGH SPEED
S321
QUANTIZE ALL LL COEFFICIENTS OF DECOMPOSITION LEVEL n
S322
QUANTIZE ALL HL COEFFICIENTS OF DECOMPOSITION LEVEL n
S323
QUANTIZE ALL LH COEFFICIENTS OF DECOMPOSITION LEVEL n
S324
QUANTIZE ALL HH COEFFICIENTS OF DECOMPOSITION LEVEL n
S325
S326
n = 1?
NO
YES
S327
n = n - 1
RETURN

FIG.29A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.14	0.28	0.58	1.14
LH	0.07	0.14	0.28	0.58	1.14
HH	0.13	0.27	0.56	1.19	2.22

FIG.29B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.06	0.13	0.26	0.55	1.10
LH	0.06	0.13	0.26	0.55	1.10
HH	0.13	0.26	0.53	1.15	2.13

FIG.29C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.04				
HL	0.07	0.15	0.30	0.64	1.26
LH	0.07	0.15	0.30	0.64	1.26
HH	0.15	0.30	0.61	1.31	2.44

FIG.30A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	1.00	1.00	1.00	1.00	0.76
LH	1.00	1.00	1.00	1.00	0.76
HH	1.00	1.00	1.00	1.00	0.57

FIG.30B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.88	0.79	0.65	0.45	0.23
LH	0.88	0.79	0.65	0.45	0.23
HH	0.83	0.71	0.53	0.31	0.11

FIG.30C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.91	0.84	0.73	0.55	0.34
LH	0.91	0.84	0.73	0.55	0.34
HH	0.87	0.78	0.63	0.42	0.20

FIG.31A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.14	0.28	0.58	1.51
LH	0.07	0.14	0.28	0.58	1.51
HH	0.13	0.27	0.56	1.20	3.87

FIG.31B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.16	0.41	1.23	4.75
LH	0.07	0.16	0.41	1.23	4.75
HH	0.15	0.36	1.00	3.71	18.72

FIG.31C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.04				
HL	0.08	0.18	0.42	1.15	3.74
LH	0.08	0.18	0.42	1.15	3.74
HH	0.17	0.38	0.98	3.14	12.19

FIG.32A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	1.00	1.00	1.00	0.86	0.31
LH	1.00	1.00	1.00	0.86	0.31
HH	1.00	1.00	1.00	0.74	0.11

FIG.32B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.82	0.69	0.50	0.28	0.10
LH	0.82	0.69	0.50	0.28	0.10
HH	0.75	0.58	0.36	0.15	0.03

FIG.32C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.86	0.76	0.60	0.39	0.18
LH	0.86	0.76	0.60	0.39	0.18
HH	0.80	0.67	0.47	0.25	0.08

FIG.33A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.14	0.28	0.67	3.72
LH	0.07	0.14	0.28	0.67	3.72
HH	0.13	0.27	0.56	1.61	20.38

FIG.33B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.08	0.19	0.53	1.98	11.20
LH	0.08	0.19	0.53	1.98	11.20
HH	0.17	0.44	1.47	7.52	68.31

FIG.33C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.04				
HL	0.09	0.20	0.51	1.64	7.08
LH	0.09	0.20	0.51	1.64	7.08
HH	0.18	0.44	1.30	5.29	31.68

FIG.34A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	1.00	1.00	0.92	0.41	0.04
LH	1.00	1.00	0.92	0.41	0.04
HH	1.00	1.00	0.85	0.18	0.00

FIG.34B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.72	0.54	0.32	0.12	0.02
LH	0.72	0.54	0.32	0.12	0.02
HH	0.61	0.40	0.19	0.04	0.00

FIG.34C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.78	0.63	0.43	0.21	0.06
LH	0.78	0.63	0.43	0.21	0.06
HH	0.70	0.51	0.29	0.10	0.01

FIG.35A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.14	0.30	1.41	29.66
LH	0.07	0.14	0.30	1.41	29.66
HH	0.13	0.27	0.65	6.53	721.86

FIG.35B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.09	0.24	0.83	4.47	47.00
LH	0.09	0.24	0.83	4.47	47.00
HH	0.21	0.64	2.87	25.62	624.05

FIG.35C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.04				
HL	0.09	0.24	0.71	3.01	20.85
LH	0.09	0.24	0.71	3.01	20.85
HH	0.21	0.58	2.13	13.06	163.15

FIG.36A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	1.00	1.00	1.00	1.00	0.76
LH	1.00	1.00	1.00	1.00	1.00
HH	1.00	1.00	1.00	1.00	0.57

FIG.36B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.88	0.79	0.65	0.45	0.23
LH	0.88	0.79	0.65	0.53	0.45
HH	0.83	0.71	0.53	0.31	0.11

FIG.36C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.91	0.84	0.73	0.55	0.34
LH	0.91	0.84	0.73	0.63	0.55
HH	0.87	0.78	0.63	0.42	0.20

FIG.37A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.14	0.28	0.58	1.51
LH	0.07	0.14	0.28	0.58	1.14
HH	0.13	0.27	0.56	1.20	3.87

FIG.37B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.16	0.41	1.23	4.75
LH	0.07	0.16	0.41	1.04	2.43
HH	0.15	0.36	1.00	3.71	18.72

FIG.37C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.04				
HL	0.08	0.18	0.42	1.15	3.74
LH	0.08	0.18	0.42	1.02	2.27
HH	0.17	0.38	0.98	3.14	12.19

FIG.38A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	1.00	1.00	1.00	0.86	0.31
LH	1.00	1.00	1.00	1.00	0.86
HH	1.00	1.00	1.00	0.74	0.11

FIG.38B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.82	0.69	0.50	0.28	0.10
LH	0.82	0.69	0.50	0.36	0.28
HH	0.75	0.58	0.36	0.15	0.03

FIG.38C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.86	0.76	0.60	0.39	0.18
LH	0.86	0.76	0.60	0.47	0.39
HH	0.80	0.67	0.47	0.25	0.08

FIG.39A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.14	0.28	0.67	3.72
LH	0.07	0.14	0.28	0.58	1.32
HH	0.13	0.27	0.56	1.61	20.38

FIG.39B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.08	0.19	0.53	1.98	11.20
LH	0.08	0.19	0.53	1.53	3.91
HH	0.17	0.44	1.47	7.52	68.31

FIG.39C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.04				
HL	0.09	0.20	0.51	1.64	7.08
LH	0.09	0.20	0.51	1.35	3.23
HH	0.18	0.44	1.30	5.29	31.68

FIG.40A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	1.00	1.00	0.92	0.41	0.04
LH	1.00	1.00	0.92	0.85	0.41
HH	1.00	1.00	0.85	0.18	0.00

FIG.40B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.72	0.54	0.32	0.12	0.02
LH	0.72	0.54	0.32	0.19	0.12
HH	0.61	0.40	0.19	0.04	0.00

FIG.40C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	1.00				
HL	0.78	0.63	0.43	0.21	0.06
LH	0.78	0.63	0.43	0.29	0.21
HH	0.70	0.51	0.29	0.10	0.01

FIG.41A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.07	0.14	0.30	1.41	29.66
LH	0.07	0.14	0.30	0.68	2.78
HH	0.13	0.27	0.65	6.53	721.86

FIG.41B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.03				
HL	0.09	0.24	0.83	4.47	47.00
LH	0.09	0.24	0.83	2.99	8.83
HH	0.21	0.64	2.87	25.62	624.05

FIG.41C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0.04				
HL	0.09	0.24	0.71	3.01	20.85
LH	0.09	0.24	0.71	2.21	5.93
HH	0.21	0.58	2.13	13.06	163.15

FIG.42

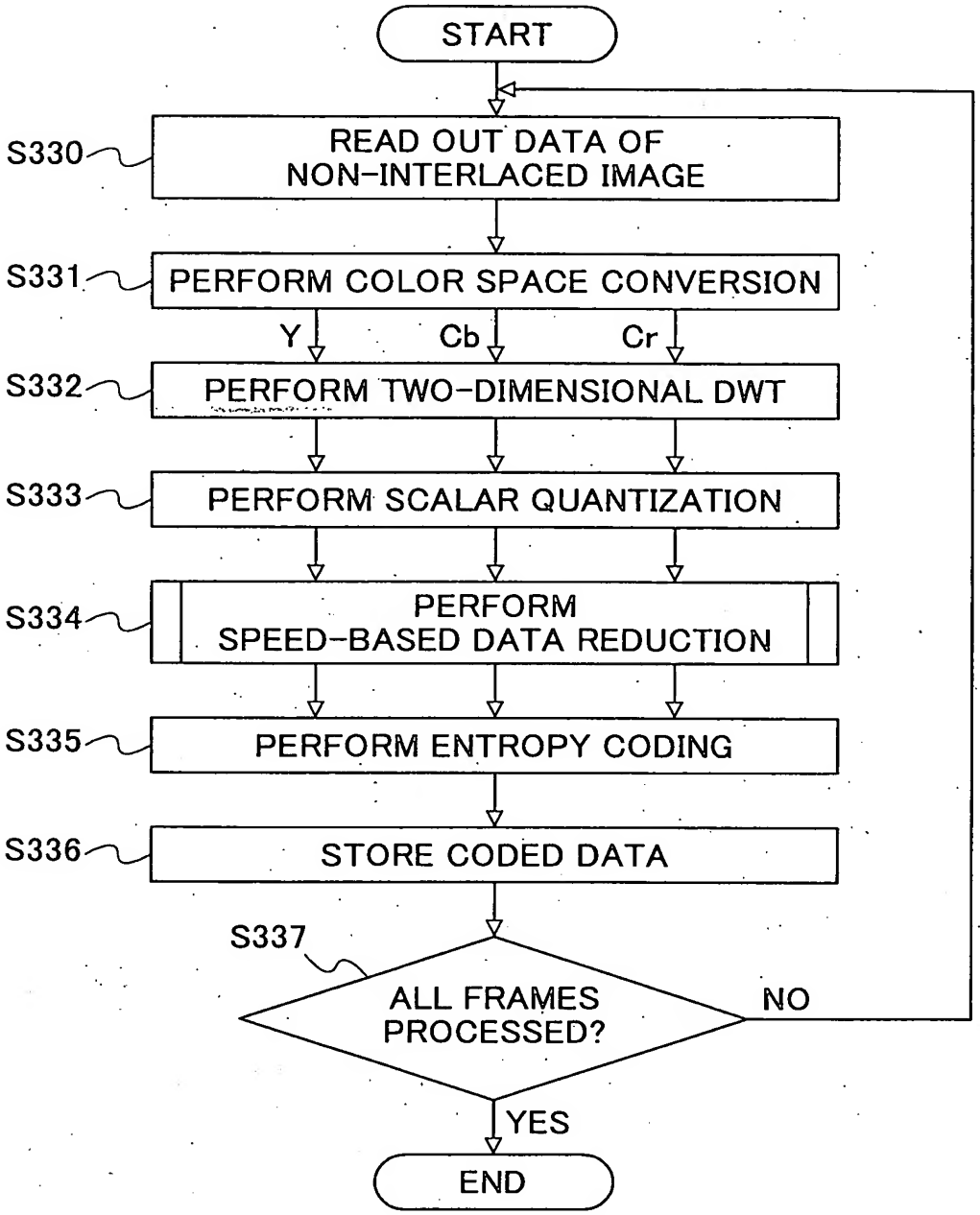

START
S330
READ OUT DATA OF NON-INTERLACED IMAGE
S331
PERFORM COLOR SPACE CONVERSION
Y
Cb
Cr
S332
PERFORM TWO-DIMENSIONAL DWT
S333
PERFORM SCALAR QUANTIZATION
S334
PERFORM SPEED-BASED DATA REDUCTION
S335
PERFORM ENTROPY CODING
S336
STORE CODED DATA
S337
ALL FRAMES PROCESSED?
NO
YES
END

FIG.43

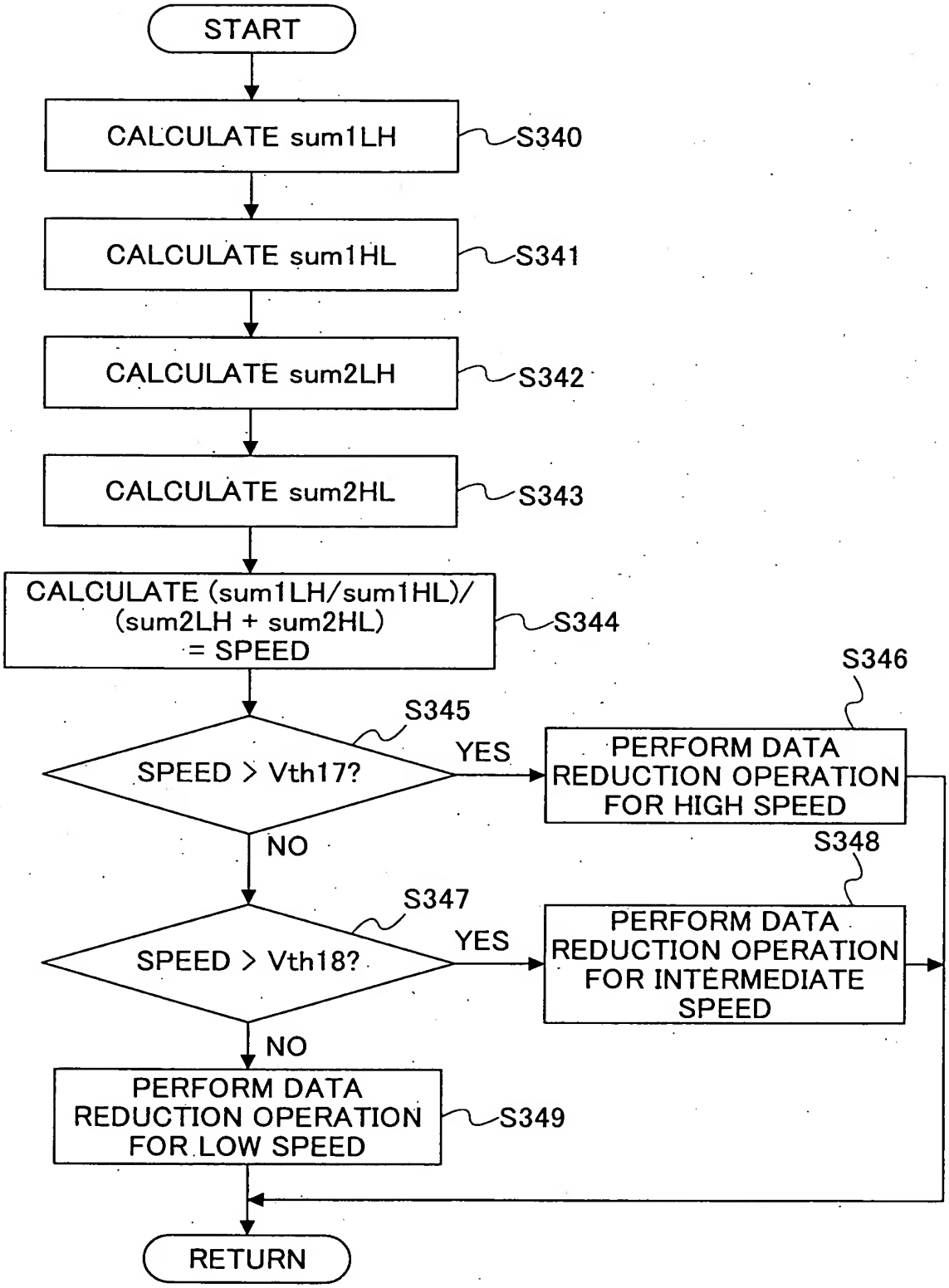

START
CALCULATE sum1LH
S340
CALCULATE sum1HL
S341
CALCULATE sum2LH
S342
CALCULATE sum2HL
S343
CALCULATE (sum1LH/sum1HL)/ (sum2LH + sum2HL) = SPEED
S344
S345
SPEED > Vth17?
YES
S346
PERFORM DATA REDUCTION OPERATION FOR HIGH SPEED
NO
S347
SPEED > Vth18?
YES
S348
PERFORM DATA REDUCTION OPERATION FOR INTERMEDIATE SPEED
NO
PERFORM DATA REDUCTION OPERATION FOR LOW SPEED
S349
RETURN

FIG.44

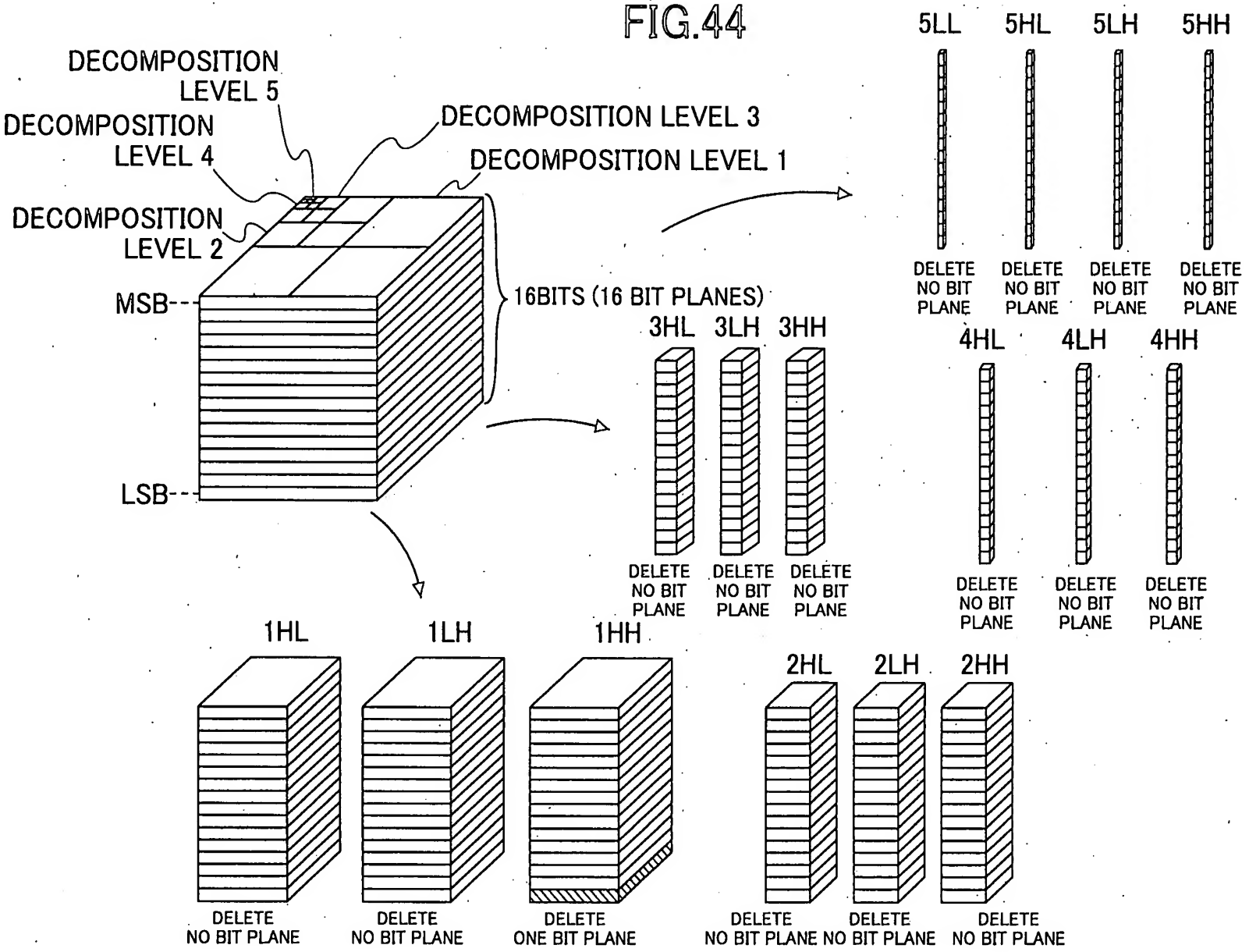

DECOMPOSITION LEVEL 5
DECOMPOSITION LEVEL 4
DECOMPOSITION LEVEL 2
DECOMPOSITION LEVEL 3
DECOMPOSITION LEVEL 1
MSB
LSB
16BITS (16 BIT PLANES)
5LL
5HL
5LH
5HH
DELETE NO BIT PLANE
3HL
3LH
3HH
4HL
4LH
4HH
1HL
1LH
1HH
DELETE ONE BIT PLANE
2HL
2LH
2HH

FIG.45A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	0	0
LH	0	0	0	0	0
HH	0	0	0	0	1

FIG.45B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	1	1	2
LH	0	0	1	1	2
HH	0	0	1	2	3

FIG.45C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	1	2
LH	0	0	0	1	2
HH	0	0	1	1	2

FIG.46A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	0	2
LH	0	0	0	0	2
HH	0	0	0	0	3

FIG.46B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	1	1	2	3
LH	0	1	1	2	3
HH	0	1	1	3	5

FIG.46C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	1	1	2
LH	0	0	1	1	2
HH	0	1	1	2	4

FIG.47A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	1	5
LH	0	0	0	1	5
HH	0	0	0	2	8

FIG.47B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	1	2	3	5
LH	0	1	2	3	5
HH	1	1	2	4	8

FIG.47C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	1	1	2	4
LH	0	1	1	2	4
HH	1	1	2	3	6

FIG.48A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	0	0
LH	0	0	0	0	0
HH	0	0	0	0	1

FIG.48B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	1	1	2
LH	0	0	1	1	1
HH	0	0	1	2	3

FIG.48C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	1	2
LH	0	0	0	1	1
HH	0	0	1	1	2

FIG.49A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	0	2
LH	0	0	0	0	0
HH	0	0	0	0	3

FIG.49B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	1	1	2	3
LH	0	1	1	1	2
HH	0	1	1	3	5

FIG.49C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	1	1	2
LH	0	0	1	1	1
HH	0	1	1	2	4

FIG.50A

Y

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	0	0	1	5
LH	0	0	0	0	1
HH	0	0	0	2	8

FIG.50B

Cb

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	1	2	3	5
LH	0	1	2	2	3
HH	1	1	2	4	8

FIG.50C

Cr

	DECOMPOSITION LEVEL				
	5	4	3	2	1
LL	0				
HL	0	1	1	2	4
LH	0	1	1	2	2
HH	1	1	2	3	6

FIG.51

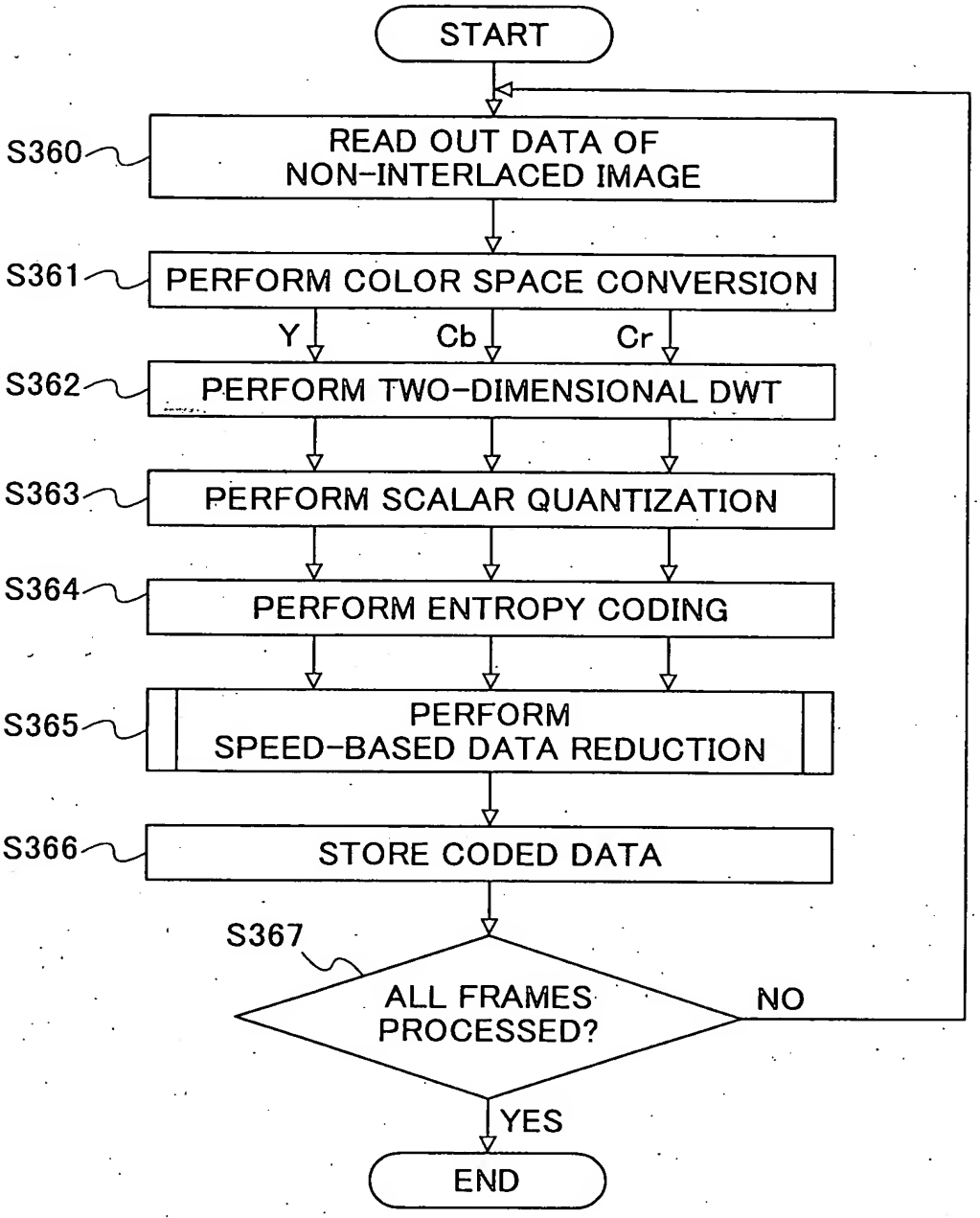

START
S360
READ OUT DATA OF NON-INTERLACED IMAGE
S361
PERFORM COLOR SPACE CONVERSION
Y
Cb
Cr
S362
PERFORM TWO-DIMENSIONAL DWT
S363
PERFORM SCALAR QUANTIZATION
S364
PERFORM ENTROPY CODING
S365
PERFORM SPEED-BASED DATA REDUCTION
S366
STORE CODED DATA
S367
ALL FRAMES PROCESSED?
NO
YES
END

FIG.52

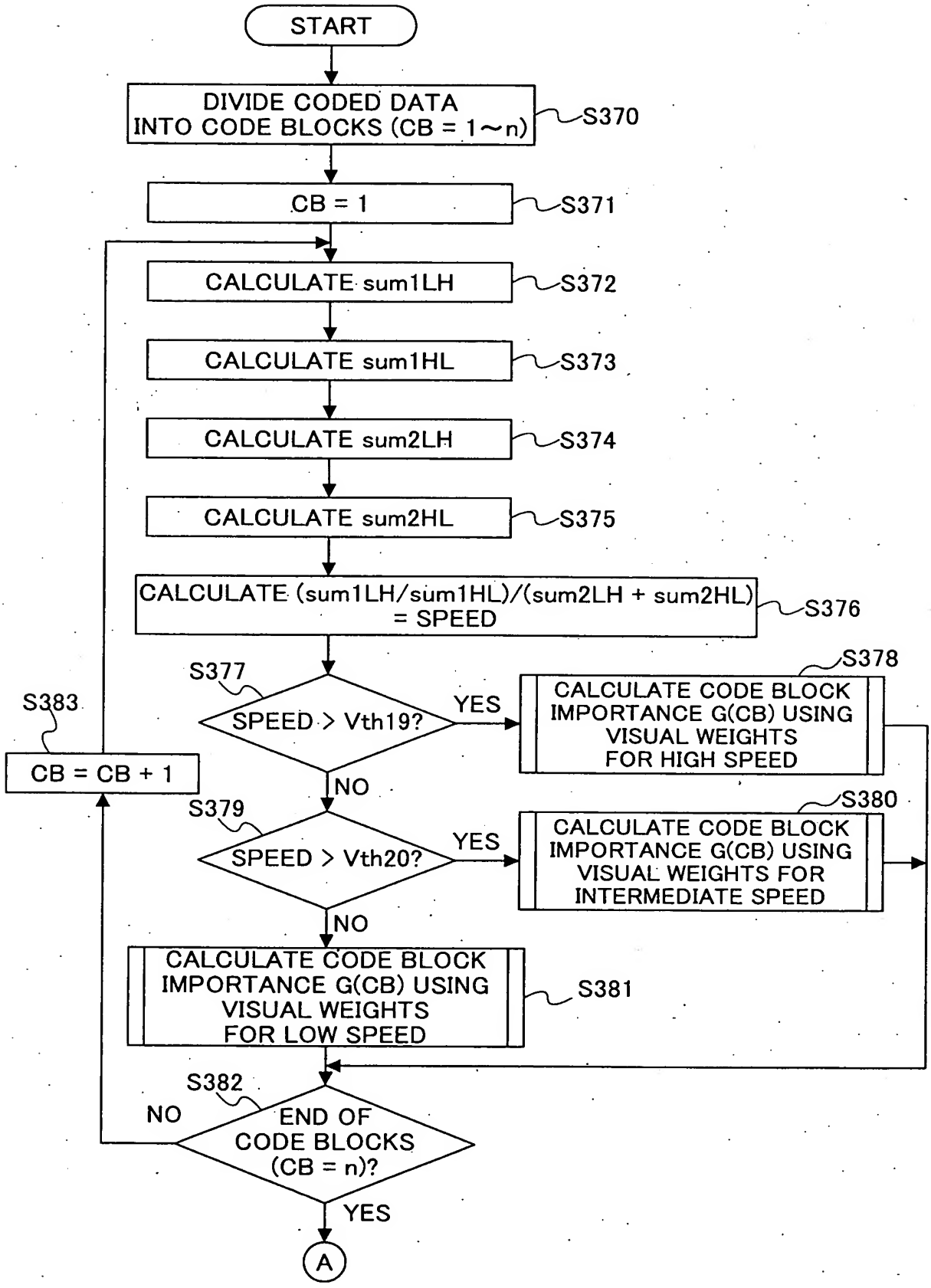

START
DIVIDE CODED DATA INTO CODE BLOCKS (CB = 1～n)
S370
CB = 1
S371
CALCULATE sum1LH
S372
CALCULATE sum1HL
S373
CALCULATE sum2LH
S374
CALCULATE sum2HL
S375
CALCULATE (sum1LH/sum1HL)/(sum2LH + sum2HL) = SPEED
S376
S377
SPEED > Vth19?
YES
S378
CALCULATE CODE BLOCK IMPORTANCE G(CB) USING VISUAL WEIGHTS FOR HIGH SPEED
NO
S379
SPEED > Vth20?
YES
S380
CALCULATE CODE BLOCK IMPORTANCE G(CB) USING VISUAL WEIGHTS FOR INTERMEDIATE SPEED
NO
CALCULATE CODE BLOCK IMPORTANCE G(CB) USING VISUAL WEIGHTS FOR LOW SPEED
S381
S382
NO
END OF CODE BLOCKS (CB = n)?
YES
A
S383
CB = CB + 1

FIG.53

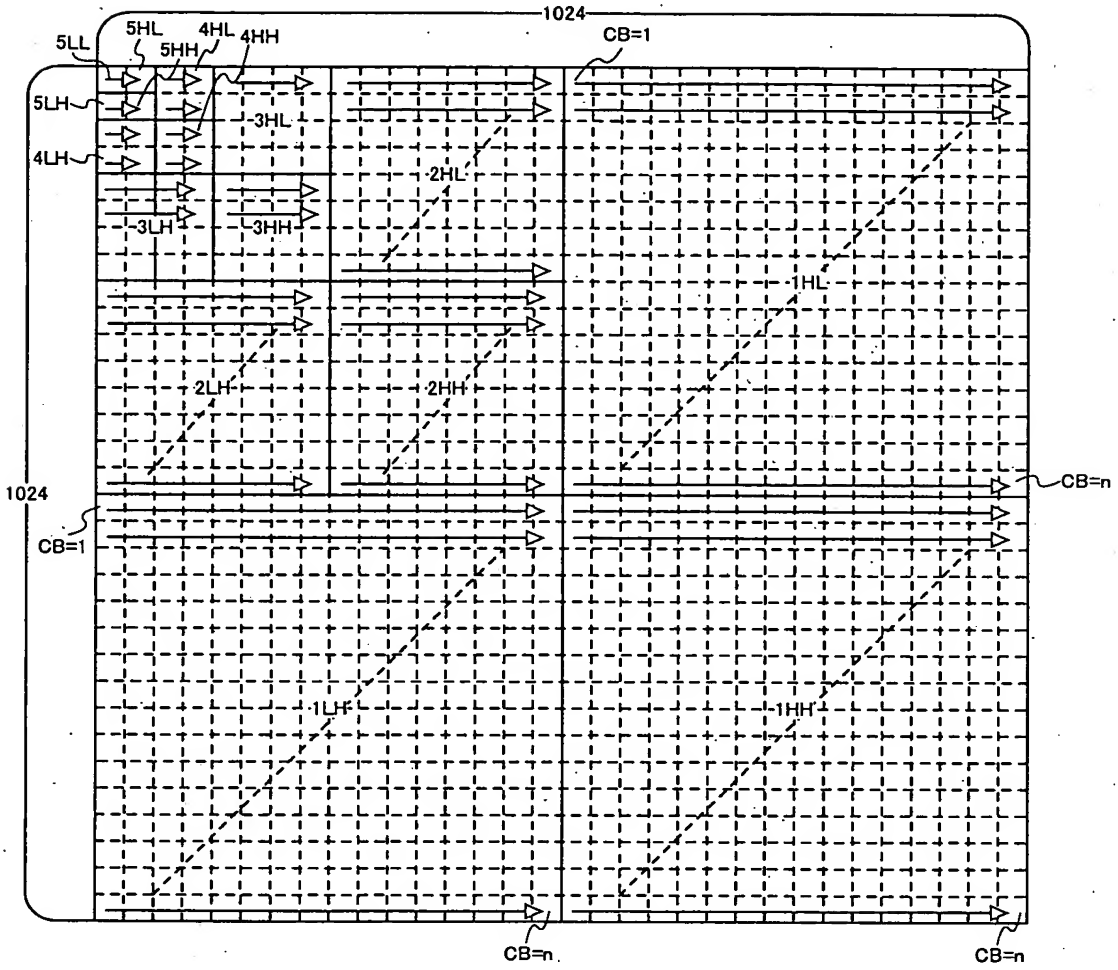

1024
5LL
5HL
5HH
4HL
4HH
CB=1
5LH
4LH
3HL
2HL
3LH
3HH
1HL
2LH
2HH
1024
CB=1
CB=n
1LH
1HH
CB=n
CB=n

FIG.54

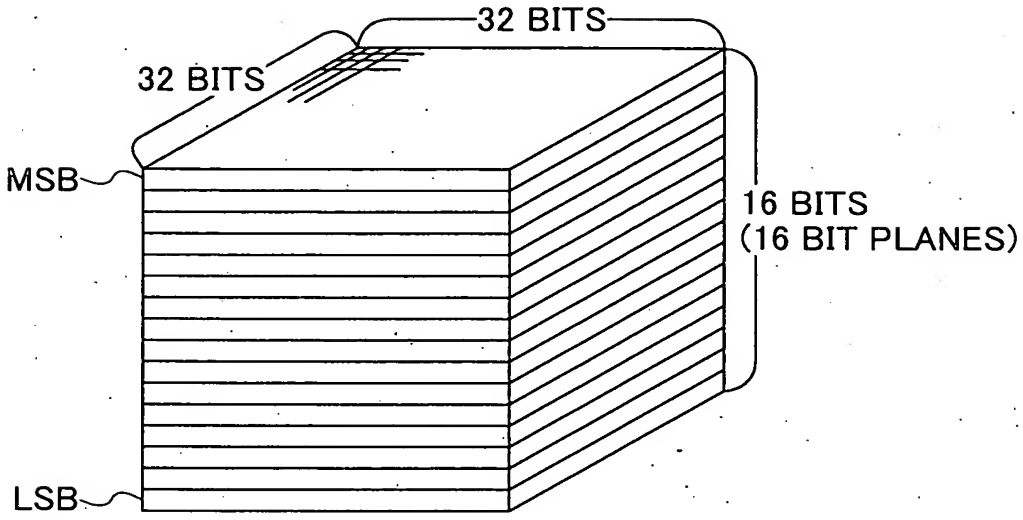


FIG.55

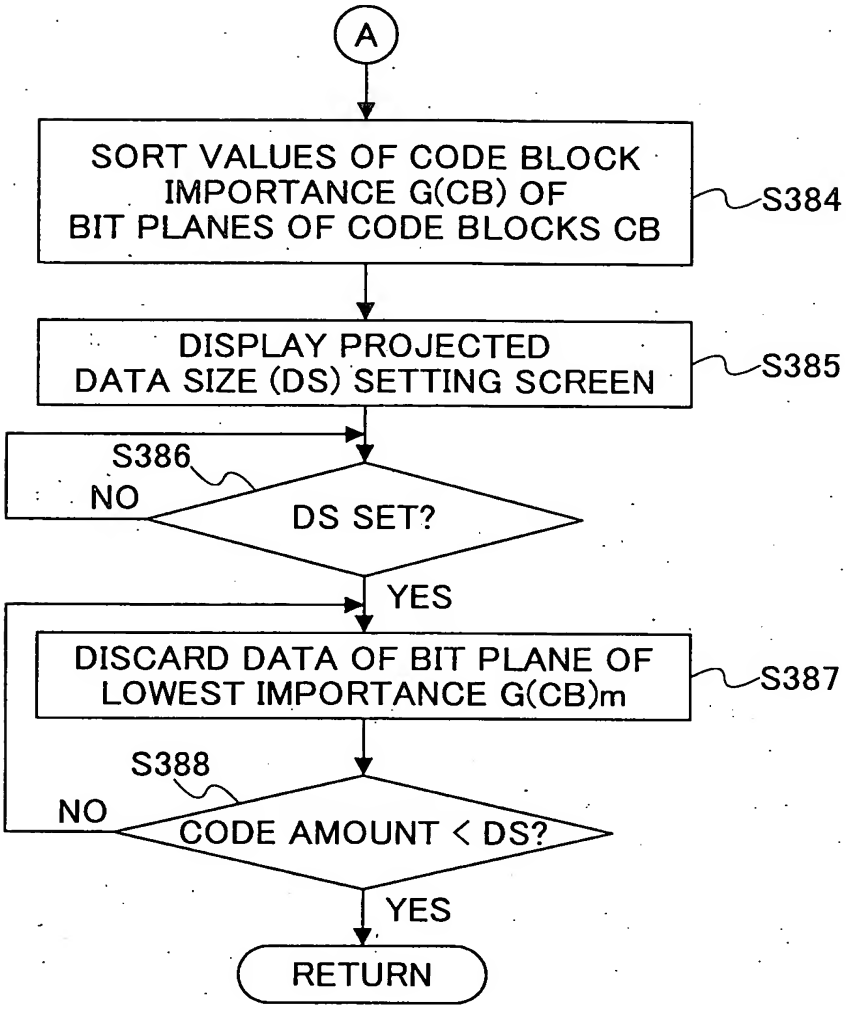

A
SORT VALUES OF CODE BLOCK IMPORTANCE G(CB) OF BIT PLANES OF CODE BLOCKS CB
S384
DISPLAY PROJECTED DATA SIZE (DS) SETTING SCREEN
S385
S386
NO
DS SET?
YES
DISCARD DATA OF BIT PLANE OF LOWEST IMPORTANCE G(CB)m
S387
S388
NO
CODE AMOUNT < DS?
YES
RETURN

FIG.56

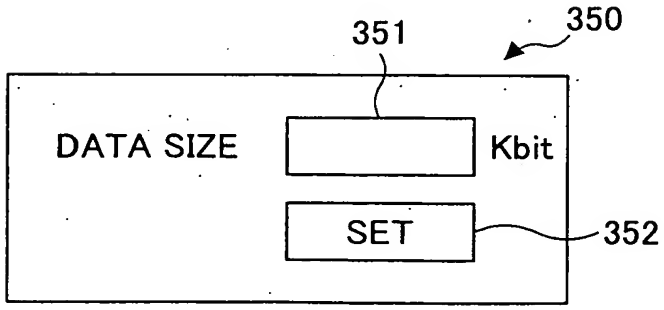

351
350
DATA SIZE
Kbit
SET
352

FIG.57

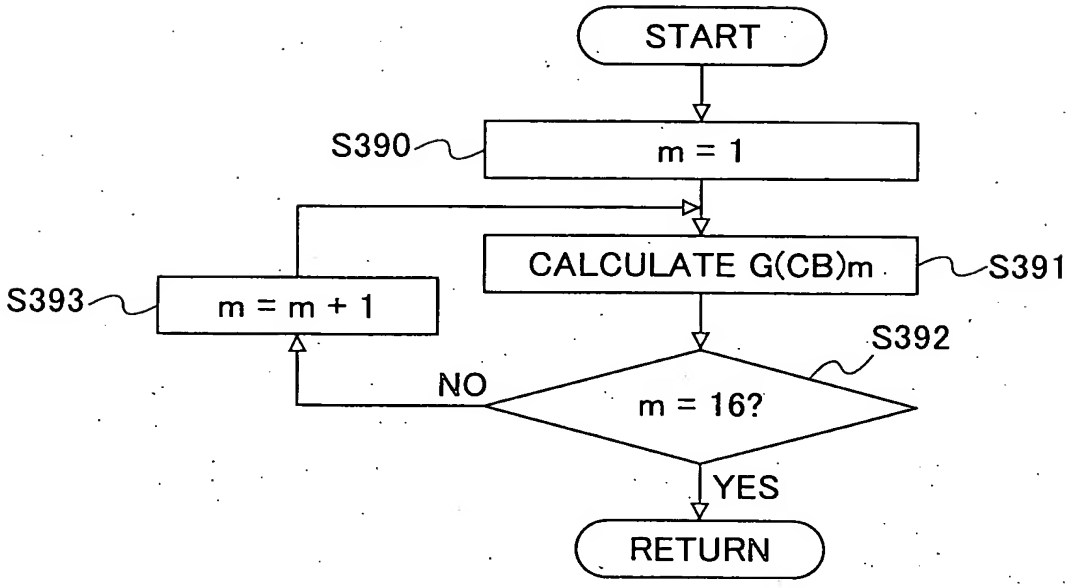

START
S390
m = 1
CALCULATE G(CB)m
S391
S393
m = m + 1
S392
NO
m = 16?
YES
RETURN

FIG.58

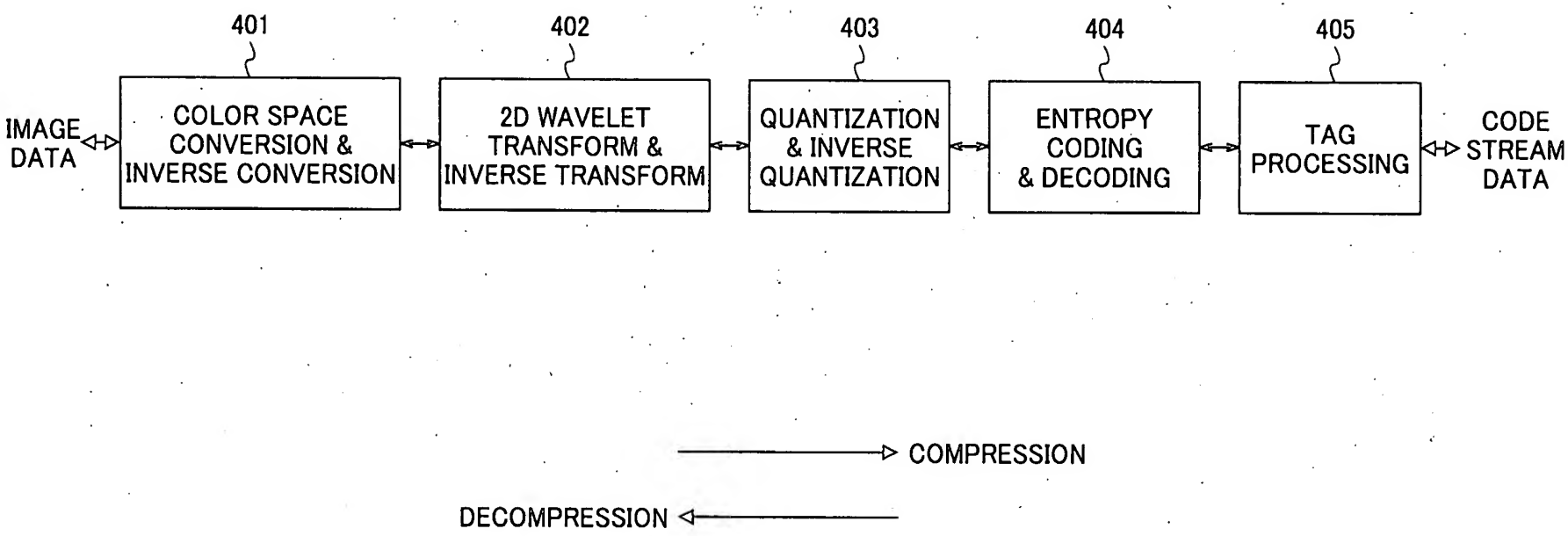

401
402
403
404
405
IMAGE DATA
COLOR SPACE CONVERSION & INVERSE CONVERSION
2D WAVELET TRANSFORM & INVERSE TRANSFORM
QUANTIZATION & INVERSE QUANTIZATION
ENTROPY CODING & DECODING
TAG PROCESSING
CODE STREAM DATA
COMPRESSION
DECOMPRESSION

FIG.59

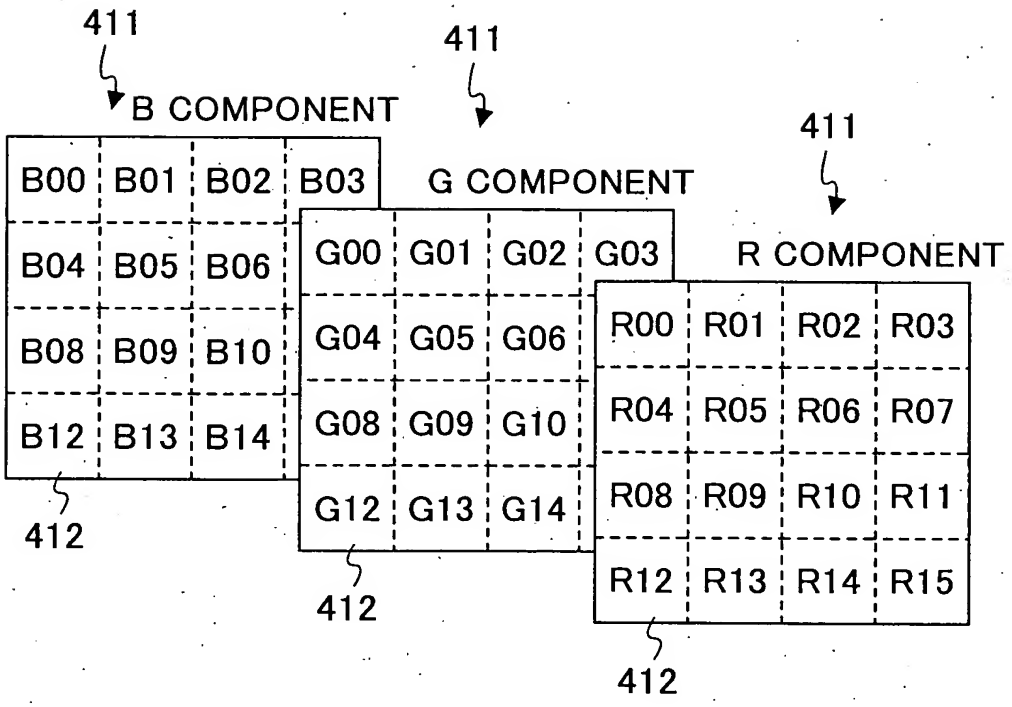
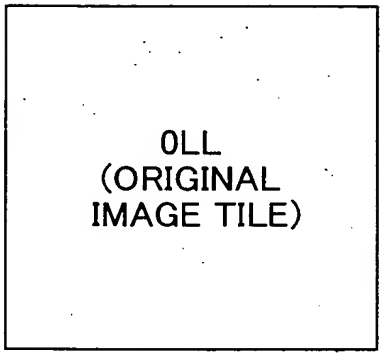
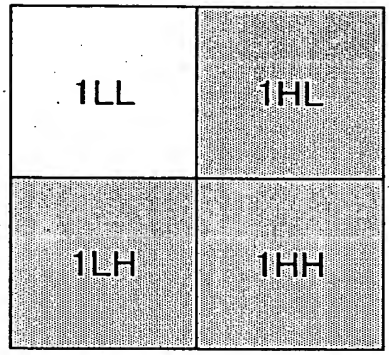

411
B COMPONENT
411
G COMPONENT
411
R COMPONENT
B00 B01 B02 B03
B04 B05 B06
B08 B09 B10
B12 B13 B14
412
G00 G01 G02 G03
G04 G05 G06
G08 G09 G10
G12 G13 G14
412
R00 R01 R02 R03
R04 R05 R06 R07
R08 R09 R10 R11
R12 R13 R14 R15
412

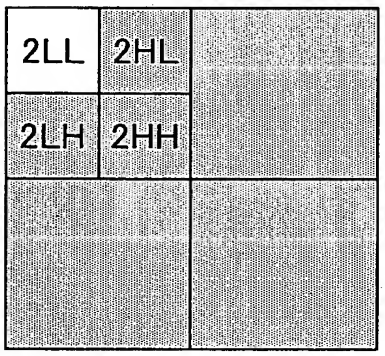
FIG.60



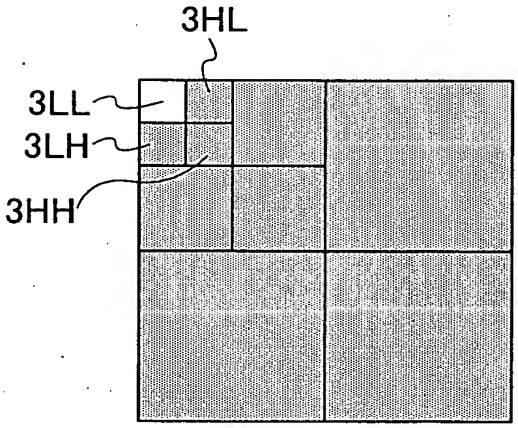
DECOMPOSITION_LEVEL_0



DECOMPOSITION_LEVEL_1



DECOMPOSITION_LEVEL_2



DECOMPOSITION_LEVEL_3

FIG.61

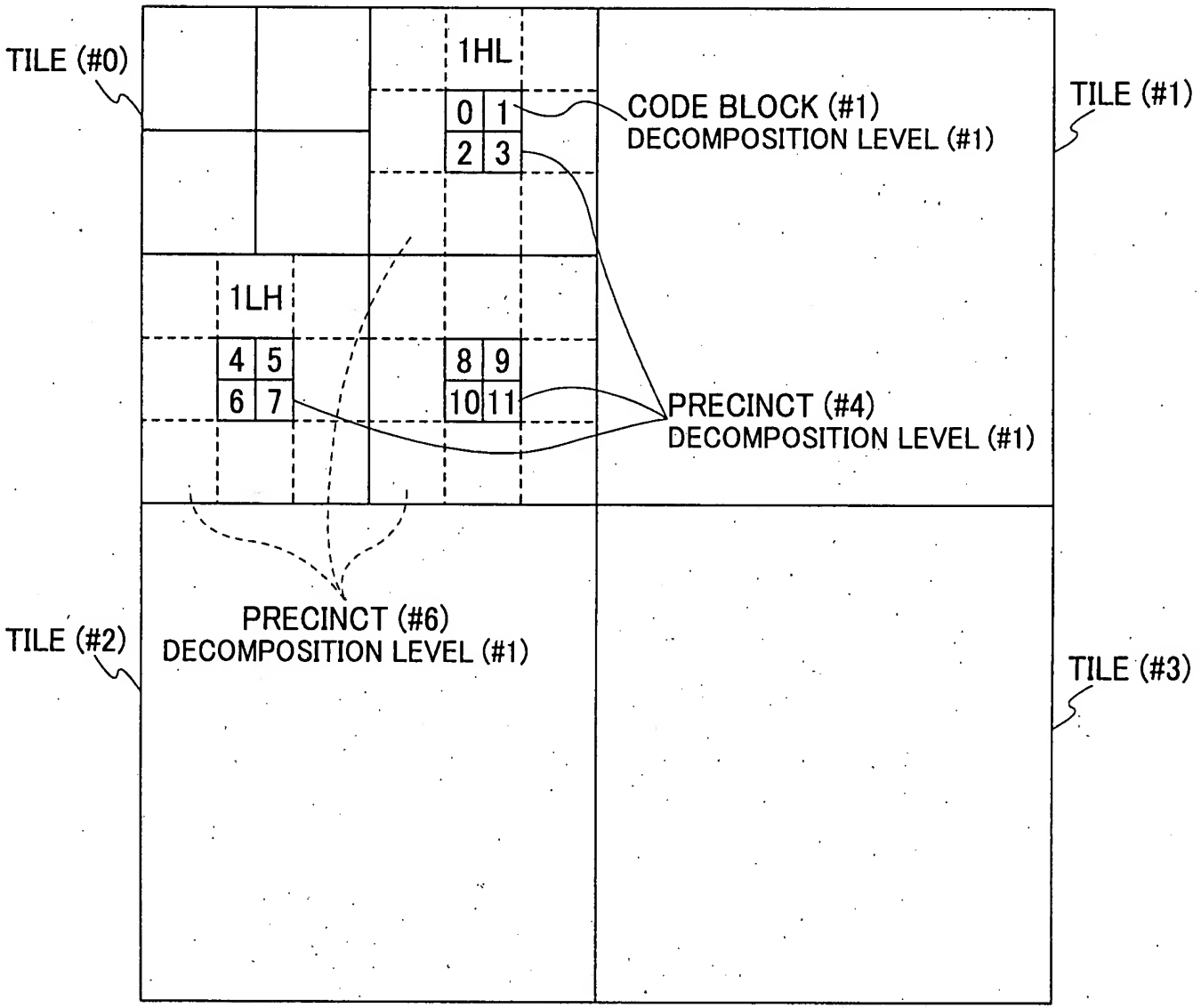

TILE (#0)
1HL
0 1
2 3
CODE BLOCK (#1)
DECOMPOSITION LEVEL (#1)
TILE (#1)
1LH
4 5
6 7
8 9
10 11
PRECINCT (#4)
DECOMPOSITION LEVEL (#1)
PRECINCT (#6)
DECOMPOSITION LEVEL (#1)
TILE (#2)
TILE (#3)

FIG.62

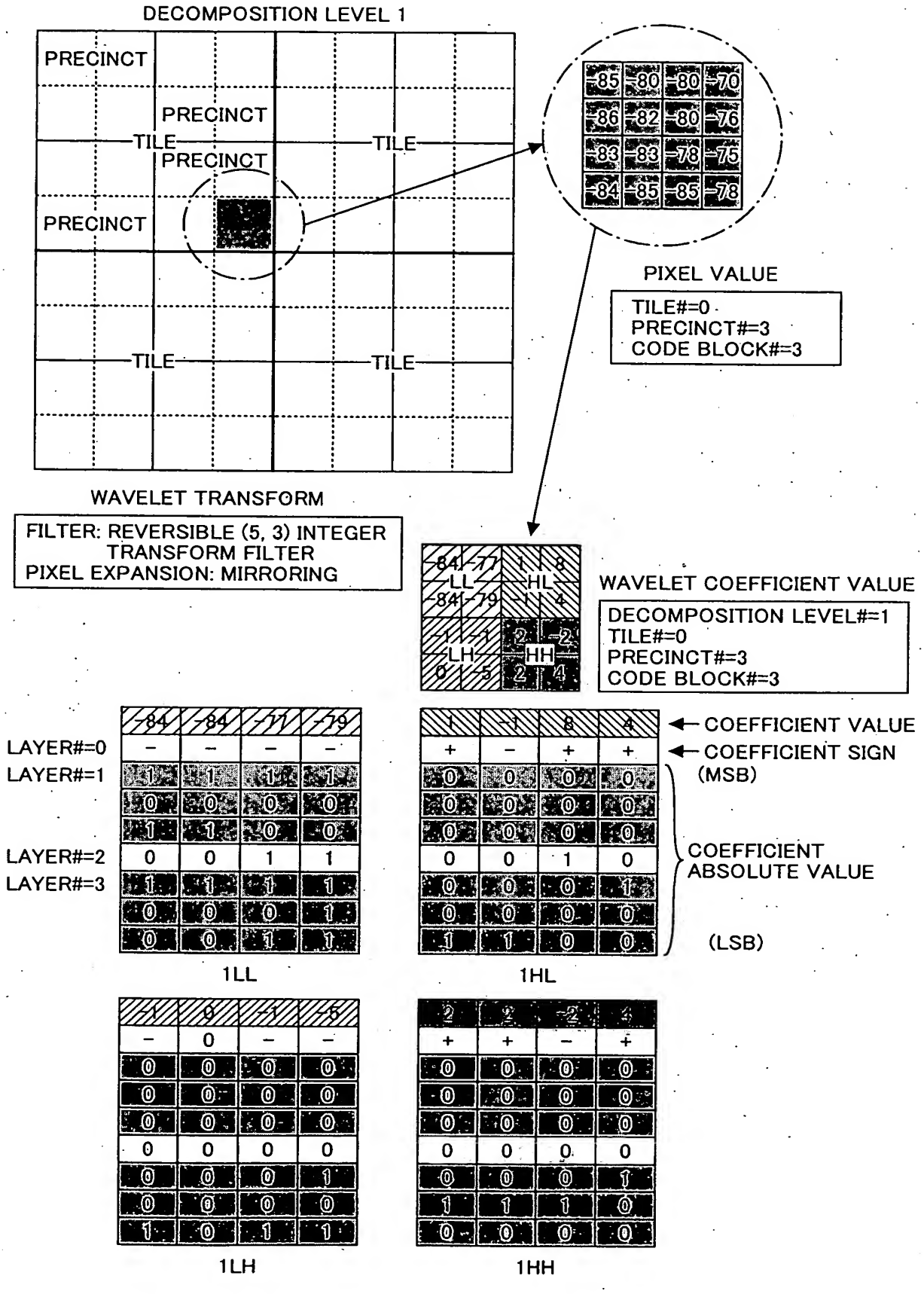

DECOMPOSITION LEVEL 1
PRECINCT
PRECINCT
TILE
TILE
PRECINCT
PRECINCT
TILE
TILE
-85 -80 -80 -70
-86 -82 -80 -76
-83 -83 -78 -75
-84 -85 -85 -78
PIXEL VALUE
TILE#=0
PRECINCT#=3
CODE BLOCK#=3
WAVELET TRANSFORM
FILTER: REVERSIBLE (5, 3) INTEGER TRANSFORM FILTER
PIXEL EXPANSION: MIRRORING
-84 -77 1 8
LL HL
-84 -79 -1 4
1 -1 2 -2
LH HH
0 -5 2 4
WAVELET COEFFICIENT VALUE
DECOMPOSITION LEVEL#=1
TILE#=0
PRECINCT#=3
CODE BLOCK#=3
-84 -84 -77 -79
LAYER#=0 - - - -
LAYER#=1 1 1 1 1
0 0 0 0
1 1 0 0
LAYER#=2 0 0 1 1
LAYER#=3 1 1 1 1
0 0 0 1
0 0 1 1
1LL
1 -1 8 4
COEFFICIENT VALUE
+ - + +
COEFFICIENT SIGN
(MSB)
0 0 0 0
0 0 0 0
0 0 0 0
0 0 1 0
COEFFICIENT ABSOLUTE VALUE
0 0 0 1
0 0 0 0
1 1 0 0
(LSB)
1HL
-1 0 -1 -5
- 0 - -
0 0 0 0
0 0 0 0
0 0 0 0
0 0 0 0
0 0 0 1
0 0 0 0
1 0 1 1
1LH
2 2 -2 4
+ + - +
0 0 0 0
0 0 0 0
0 0 0 0
0 0 0 0
0 0 0 1
1 1 1 0
0 0 0 0
1HH

FIG.63

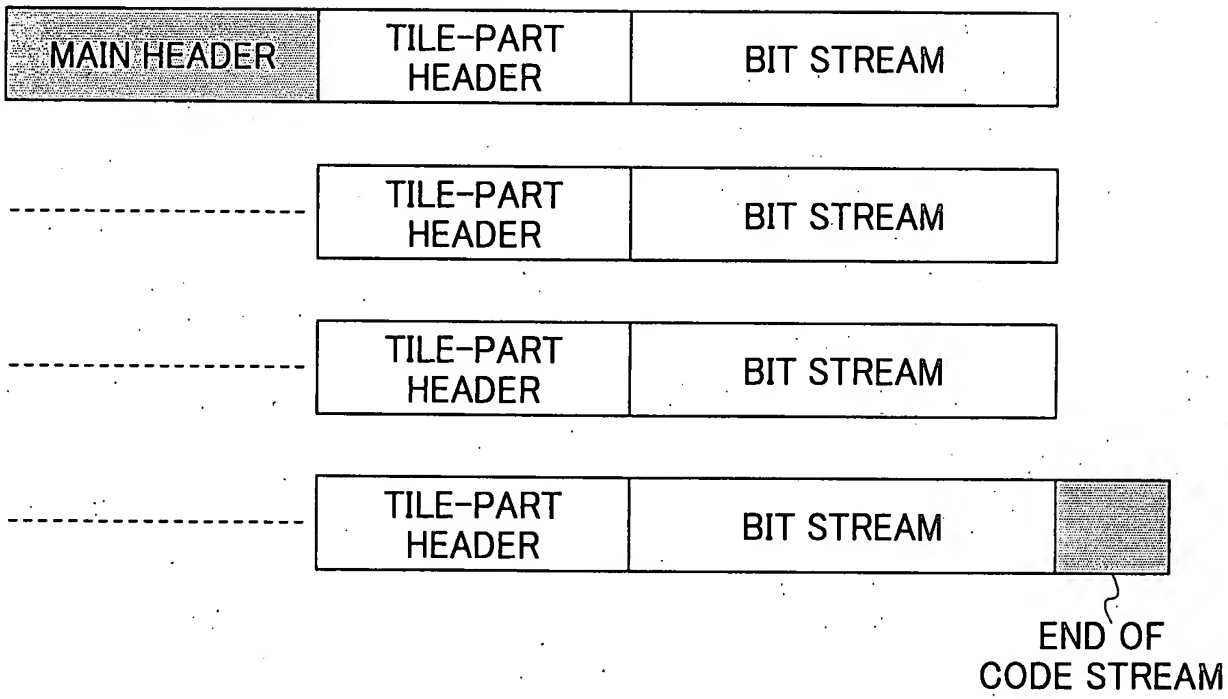

MAIN HEADER
TILE-PART HEADER
BIT STREAM
TILE-PART HEADER
BIT STREAM
TILE-PART HEADER
BIT STREAM
TILE-PART HEADER
BIT STREAM
END OF CODE STREAM

FIG.64

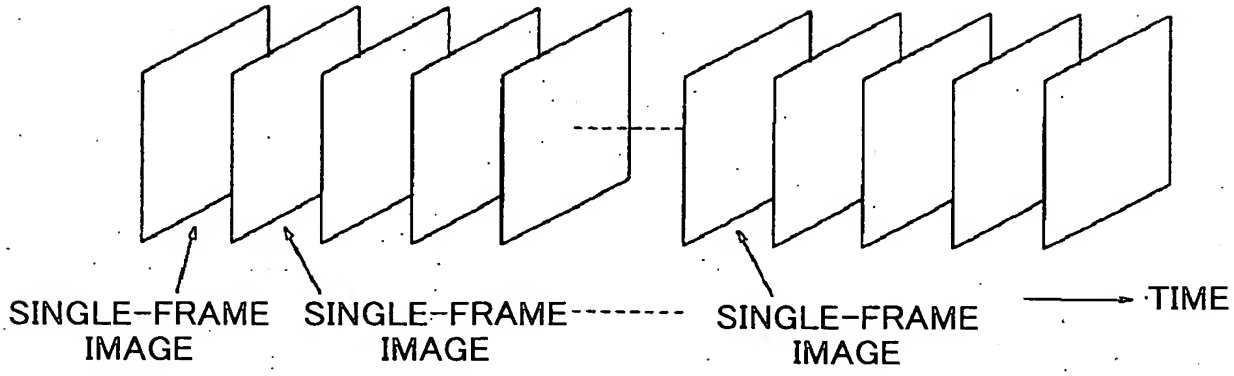

SINGLE-FRAME IMAGE
SINGLE-FRAME IMAGE
SINGLE-FRAME IMAGE
TIME

FIG.65

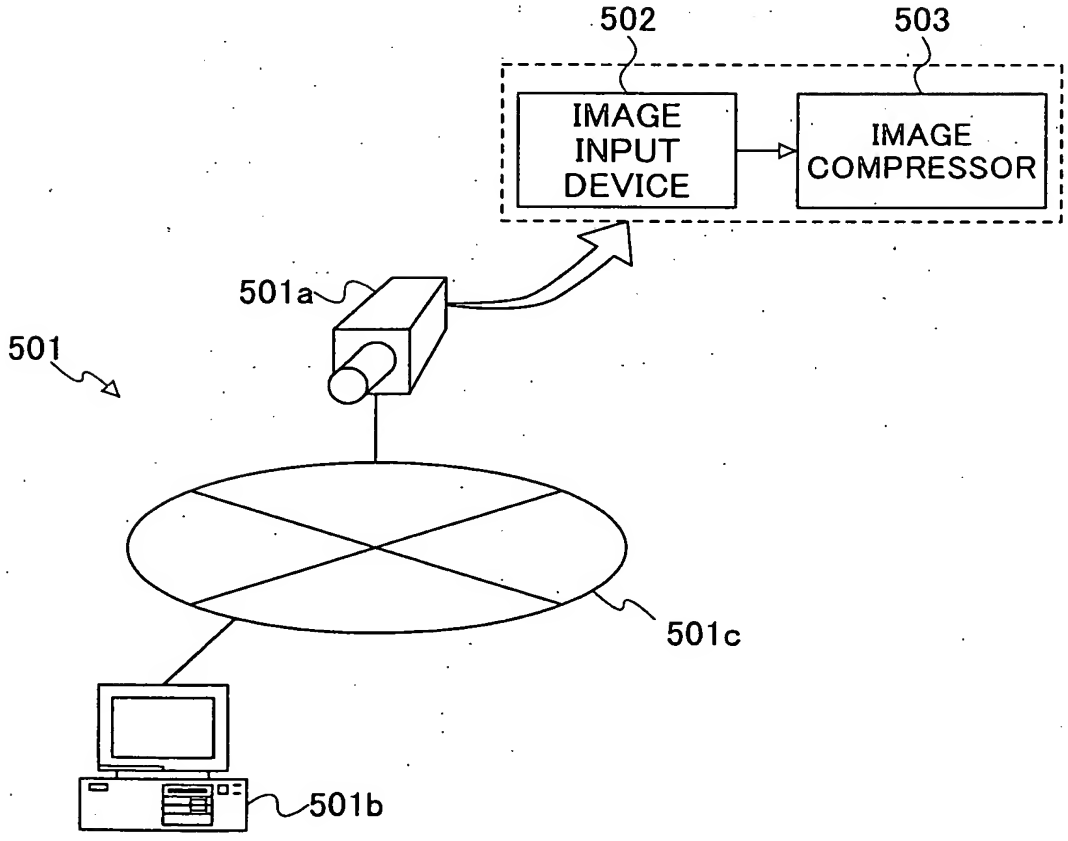

502
503
IMAGE INPUT DEVICE
IMAGE COMPRESSOR
501a
501
501c
501b

FIG.66

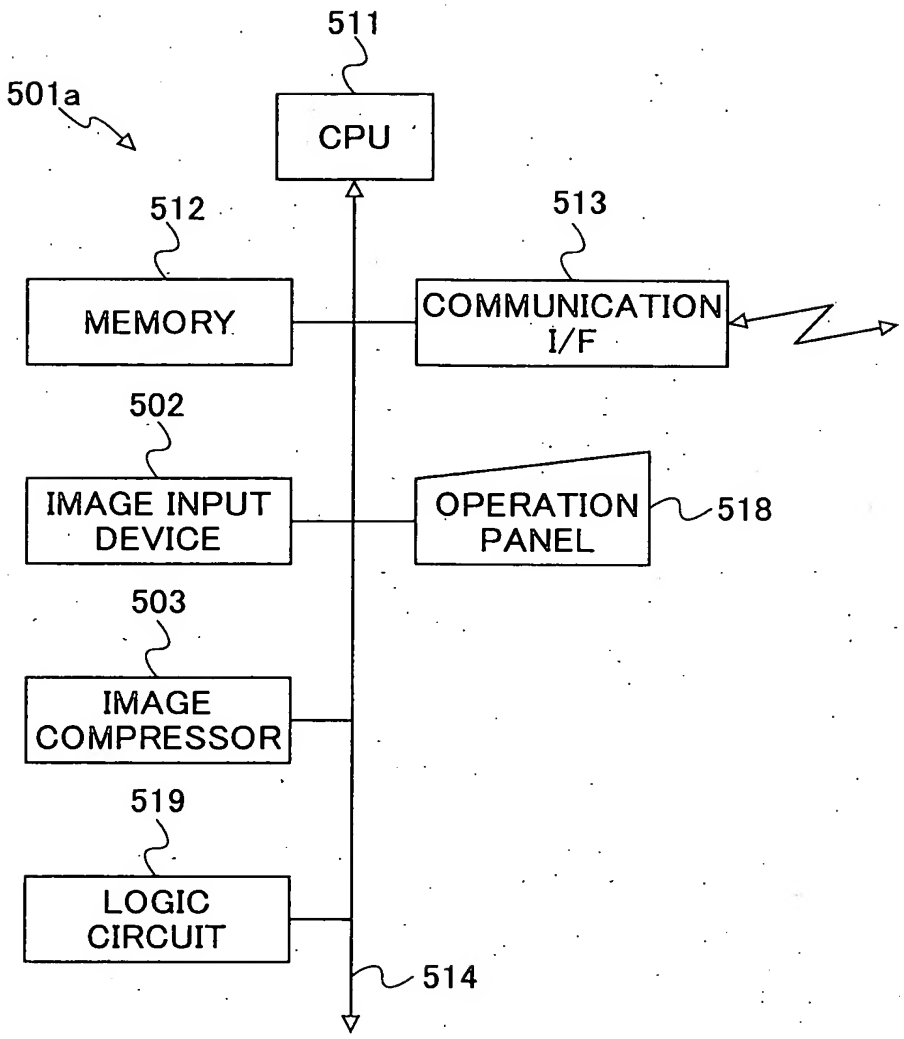

511
501a
CPU
512
513
MEMORY
COMMUNICATION I/F
502
IMAGE INPUT DEVICE
OPERATION PANEL
518
503
IMAGE COMPRESSOR
519
LOGIC CIRCUIT
514

FIG.67

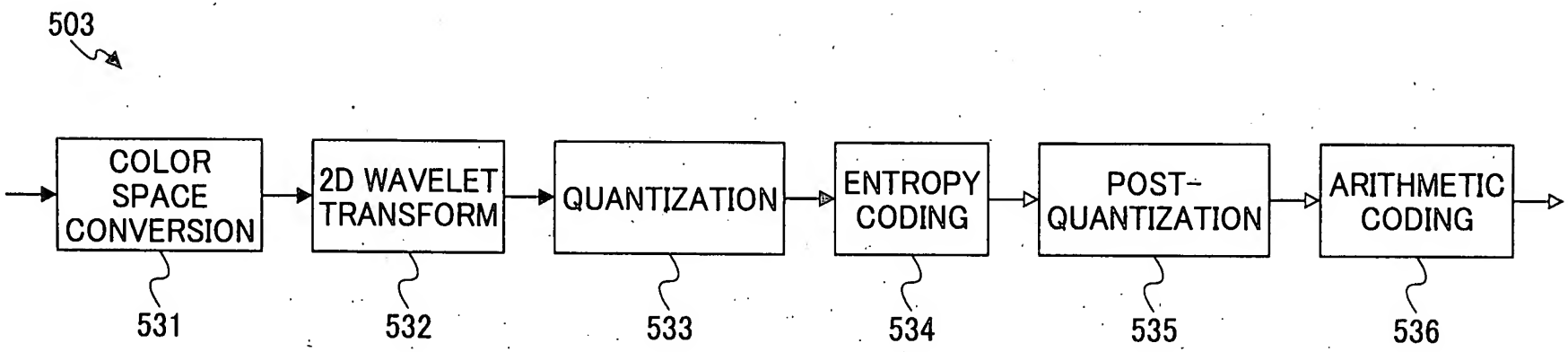

503
COLOR SPACE CONVERSION
2D WAVELET TRANSFORM
QUANTIZATION
ENTROPY CODING
POST-QUANTIZATION
ARITHMETIC CODING
531
532
533
534
535
536

FIG.68

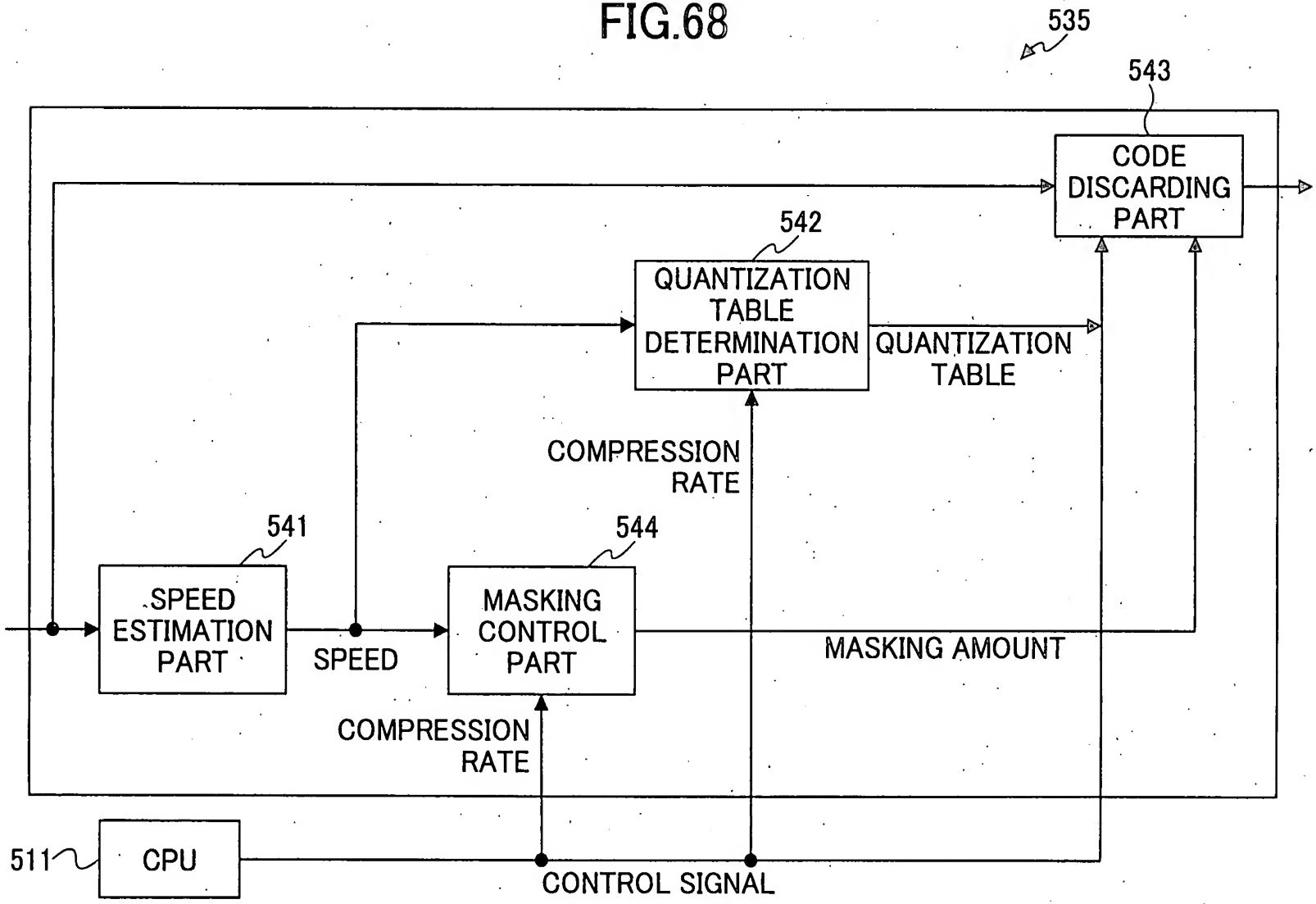
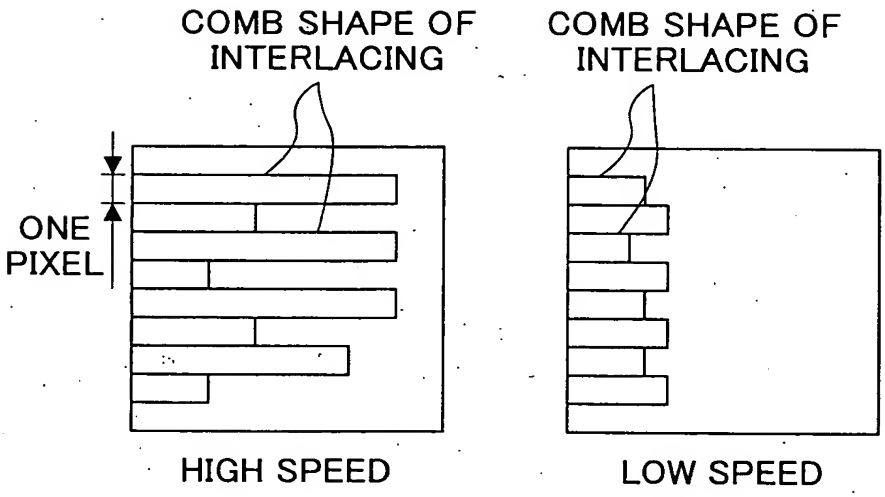

535
543
CODE DISCARDING PART
542
QUANTIZATION TABLE DETERMINATION PART
QUANTIZATION TABLE
COMPRESSION RATE
541
544
SPEED ESTIMATION PART
SPEED
MASKING CONTROL PART
MASKING AMOUNT
COMPRESSION RATE
511
CPU
CONTROL SIGNAL

FIG.69



CODE BLOCK OF HIGHER SPEED HAS LONGER HORIZONTAL EDGE OF HIGH FREQUENCY

CODE BLOCK OF HIGHER SPEED HAS GREATER AMOUNT OF 1LH CODES

FIG.70

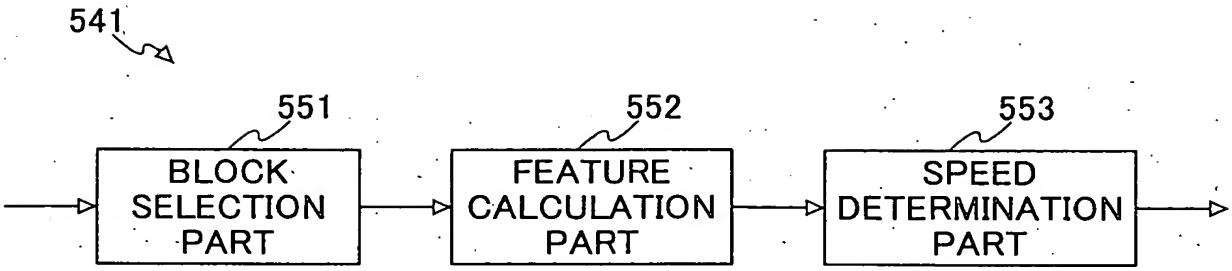


FIG.71

2LL	2HL	1HL_1	1HL_2
2LH	2HH	1HL_3	1HL_4
1LH_1	1LH_2	1HH_1	1HH_2
1LH_3	1LH_4	1HH_3	1HH_4

FIG.72

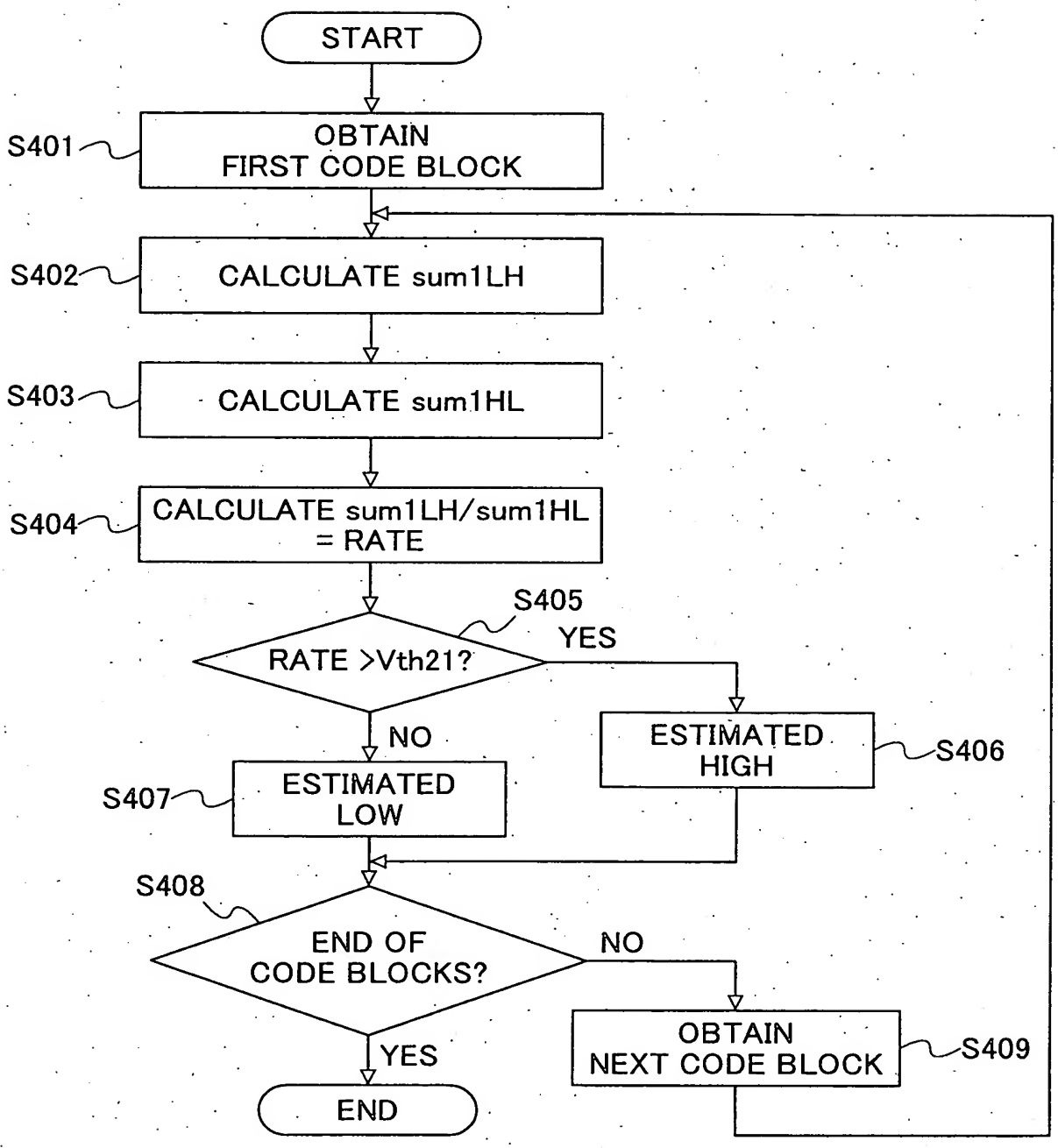

START
S401
OBTAIN FIRST CODE BLOCK
S402
CALCULATE sum1LH
S403
CALCULATE sum1HL
S404
CALCULATE sum1LH/sum1HL = RATE
S405
RATE >Vth21?
YES
NO
ESTIMATED HIGH
S406
S407
ESTIMATED LOW
S408
END OF CODE BLOCKS?
NO
YES
OBTAIN NEXT CODE BLOCK
S409
END

FIG.73

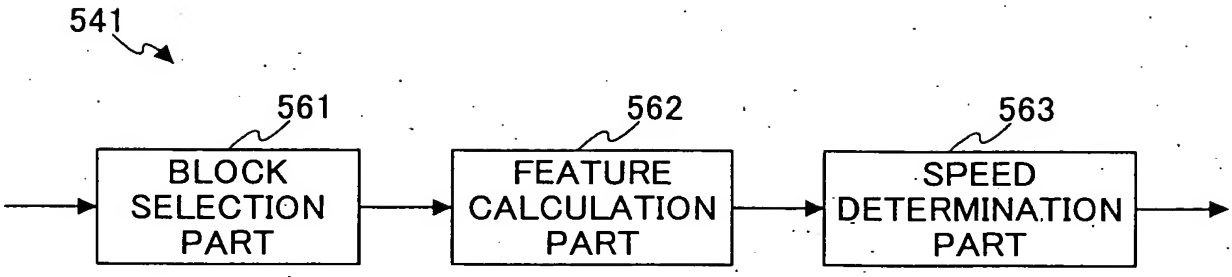


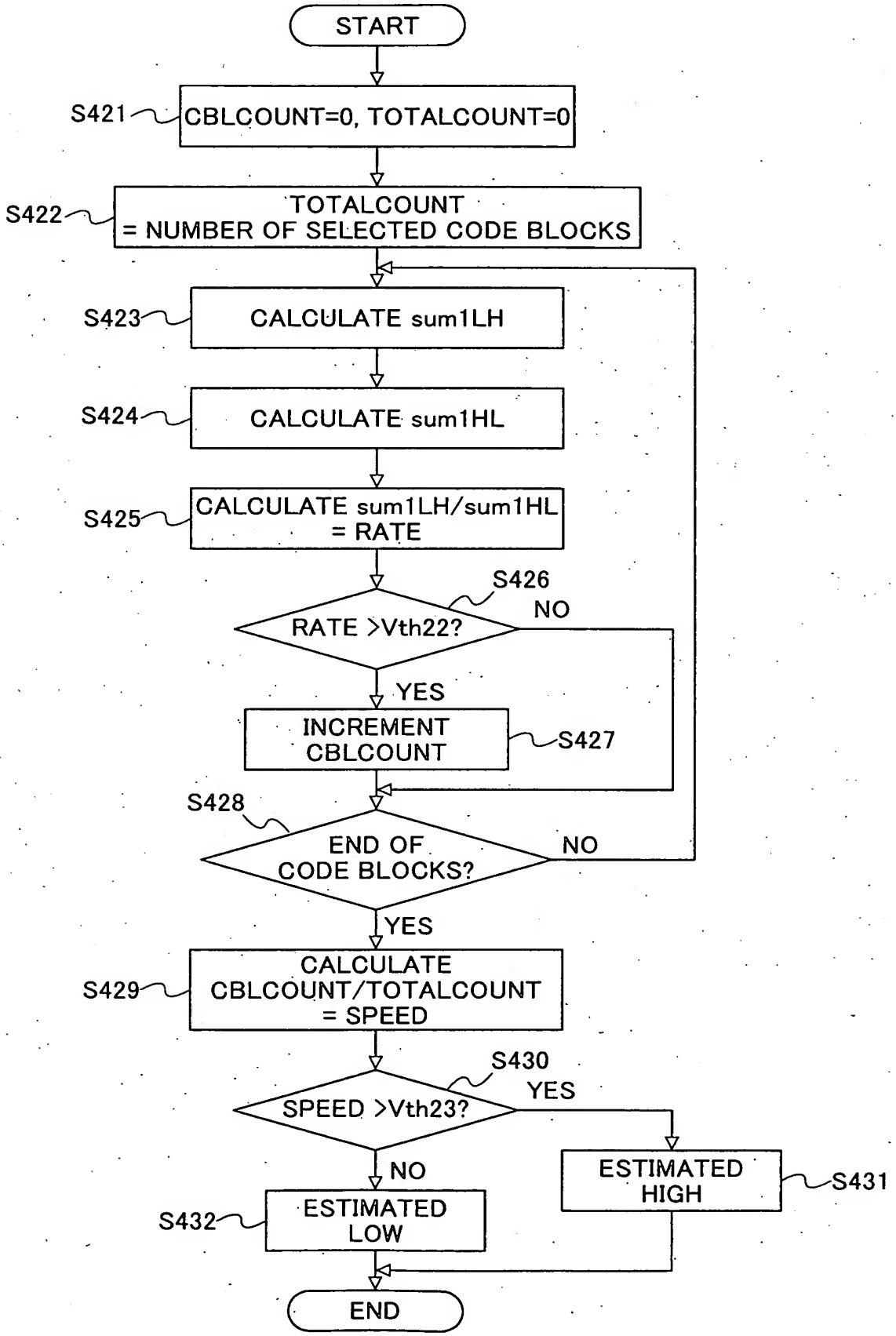
FIG.74

2LL	2HL	1HL_1	1HL_2
2LH	2HH	1HL_3	1HL_4
1LH_1 HIGH	1LH_2 HIGH	1HH_1	1HH_2
1LH_3 HIGH	1LH_4 LOW	1HH_3	1HH_4

HIGH-SPEED CODE BLOCK : 3
LOW-SPEED CODE BLOCK : 1

ENTIRE IMAGE MOTION (SPEED) : HIGH

FIG.75


START
S421
CBLCOUNT=0, TOTALCOUNT=0
S422
TOTALCOUNT
= NUMBER OF SELECTED CODE BLOCKS
S423
CALCULATE sum1LH
S424
CALCULATE sum1HL
S425
CALCULATE sum1LH/sum1HL
= RATE
S426
RATE >Vth22?
NO
YES
INCREMENT
CBLCOUNT
S427
S428
END OF
CODE BLOCKS?
NO
YES
S429
CALCULATE
CBLCOUNT/TOTALCOUNT
= SPEED
S430
SPEED >Vth23?
YES
NO
ESTIMATED
HIGH
S431
S432
ESTIMATED
LOW
END